Plates. { Drawings of McKim, Mead & White.
Drawings of Lamb & Rich.
Measured Drawing, Windows on West Side of Municipia Monza.

# THE BRICKBVILDER

DEVOTED TO THE INTERESTS OF ARCHITECTVRE IN MATERIALS OF CLAY

PUBLISHED MONTHLY.

85 WATER STREET, BOSTON, MASS.

VOLVME FIVE

JVNE MDCCCXCVI

NVMBER SIX

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THE BARTA PRESS, BOSTON.

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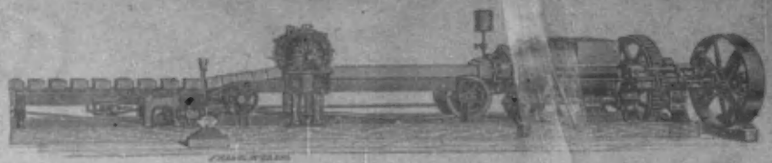
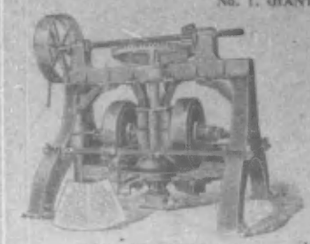
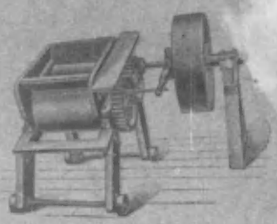


No. 1. GIANT MACHINE WITH AUTOMATIC TABLE.



DRY AND WET PANS.



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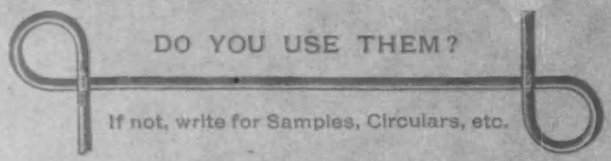


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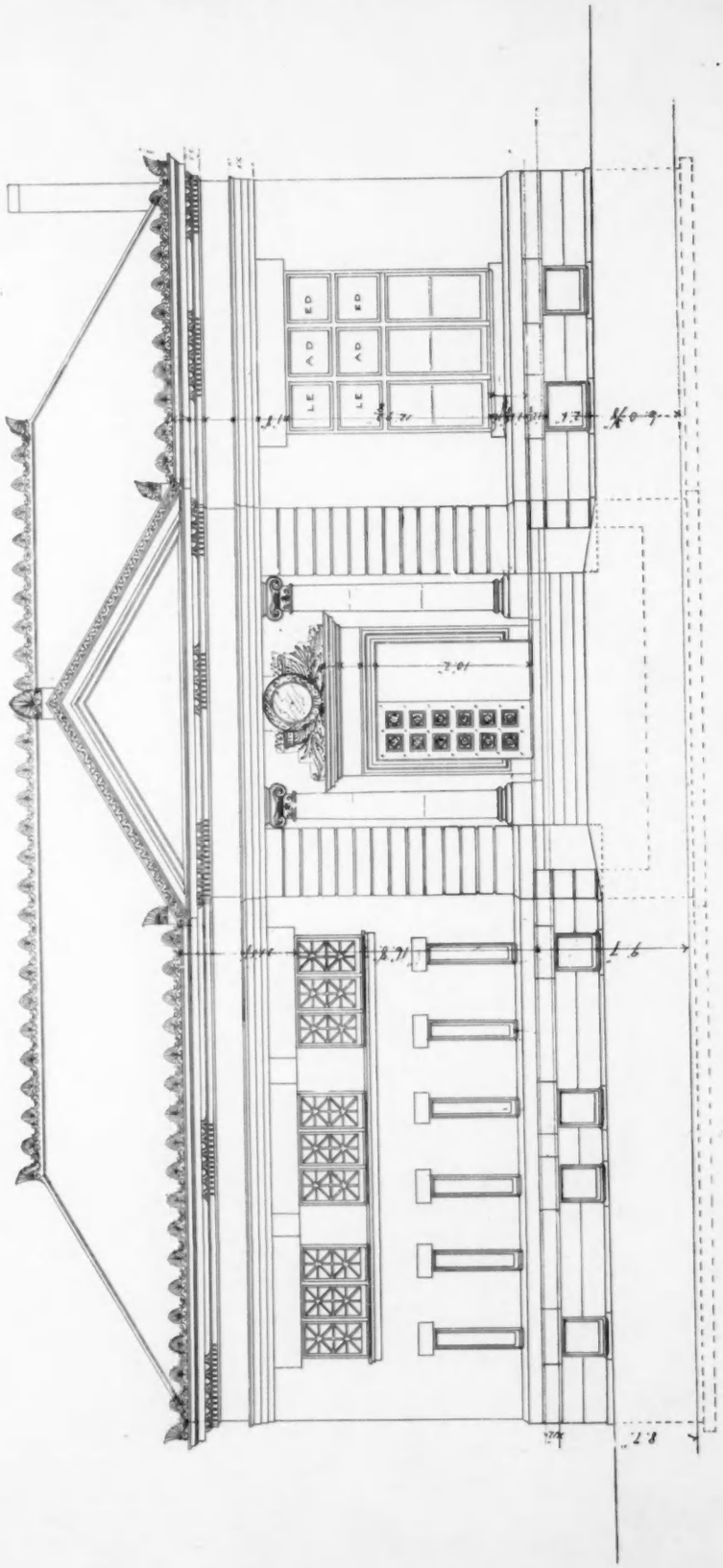

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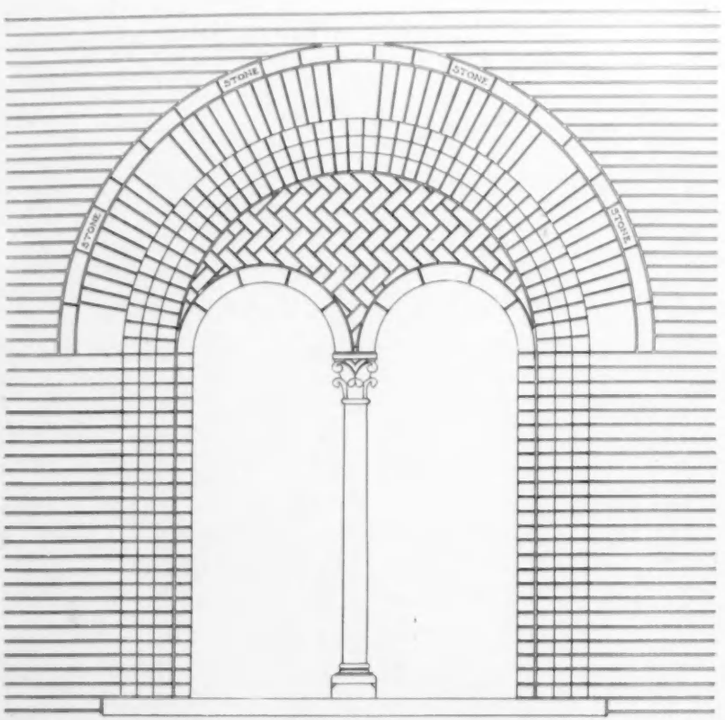
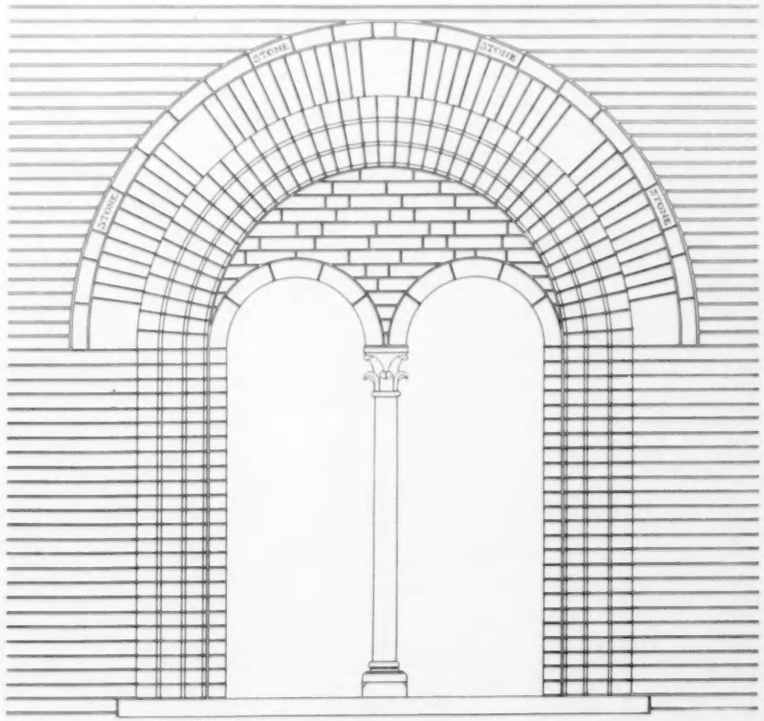



ELEVATION

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MEASURED DRAWING OF WINDOWS ON WEST SIDE OF MUNICIPIA MONZA. THIRTEENTH CENTURY.

EAST ELEVATION

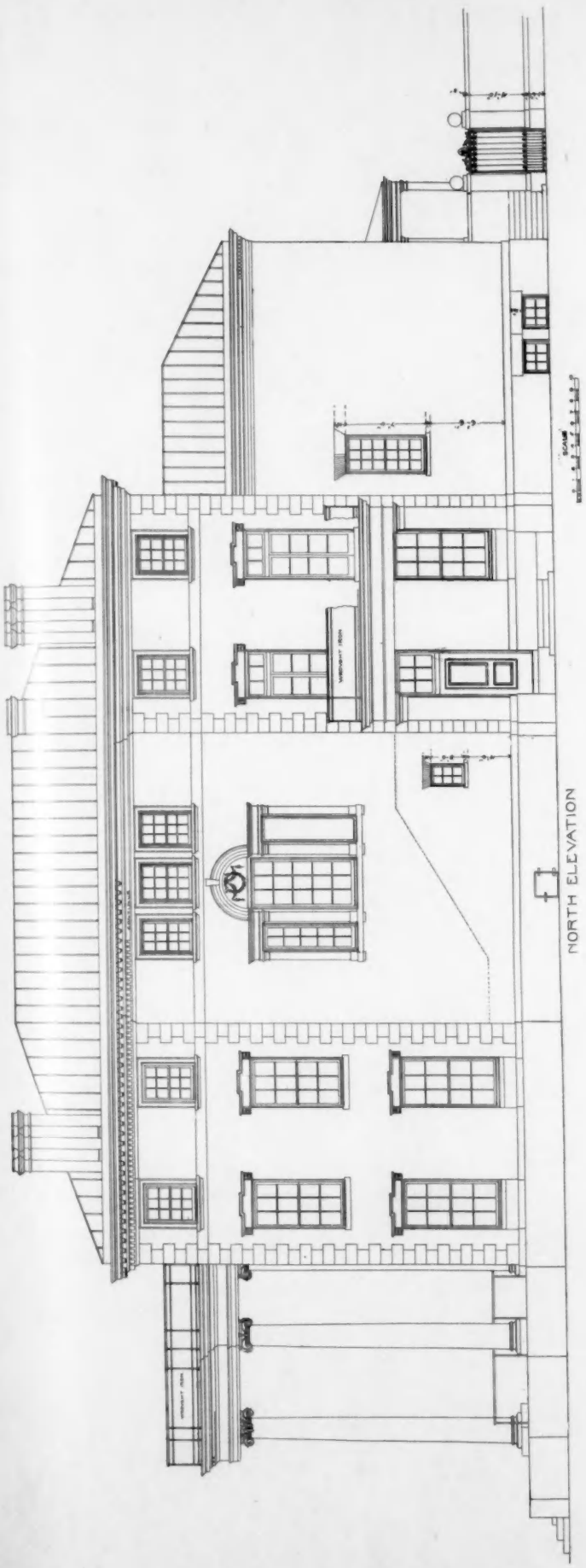
SCALE

HOUSE FOR CHARLES H
BUFFALO, N.
McKIM, MEAD & WHI

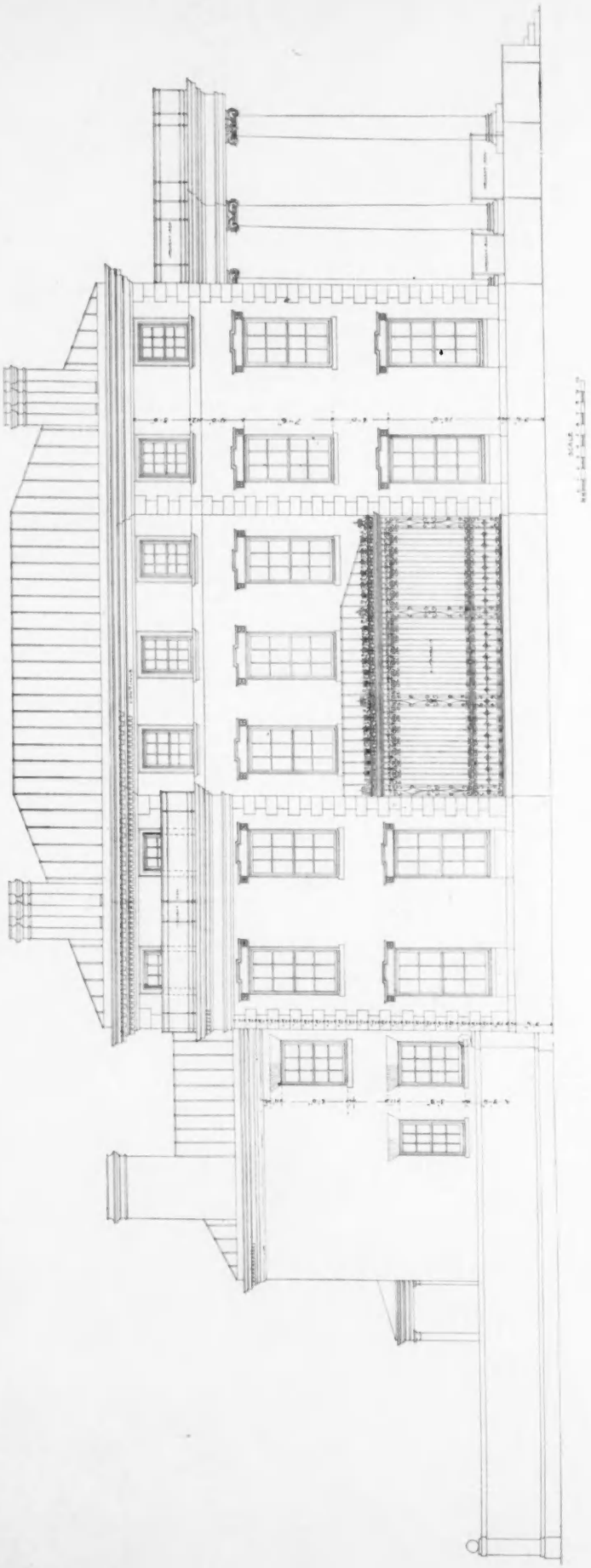
PLATES 33 and 34.

WEST ELEVATION

CHARLES H. WILLIAMS, Esq.
Buffalo, N. Y.
MEAD & WHITE, Architects.



NORTH ELEVATION



SOUTH ELEVATION.

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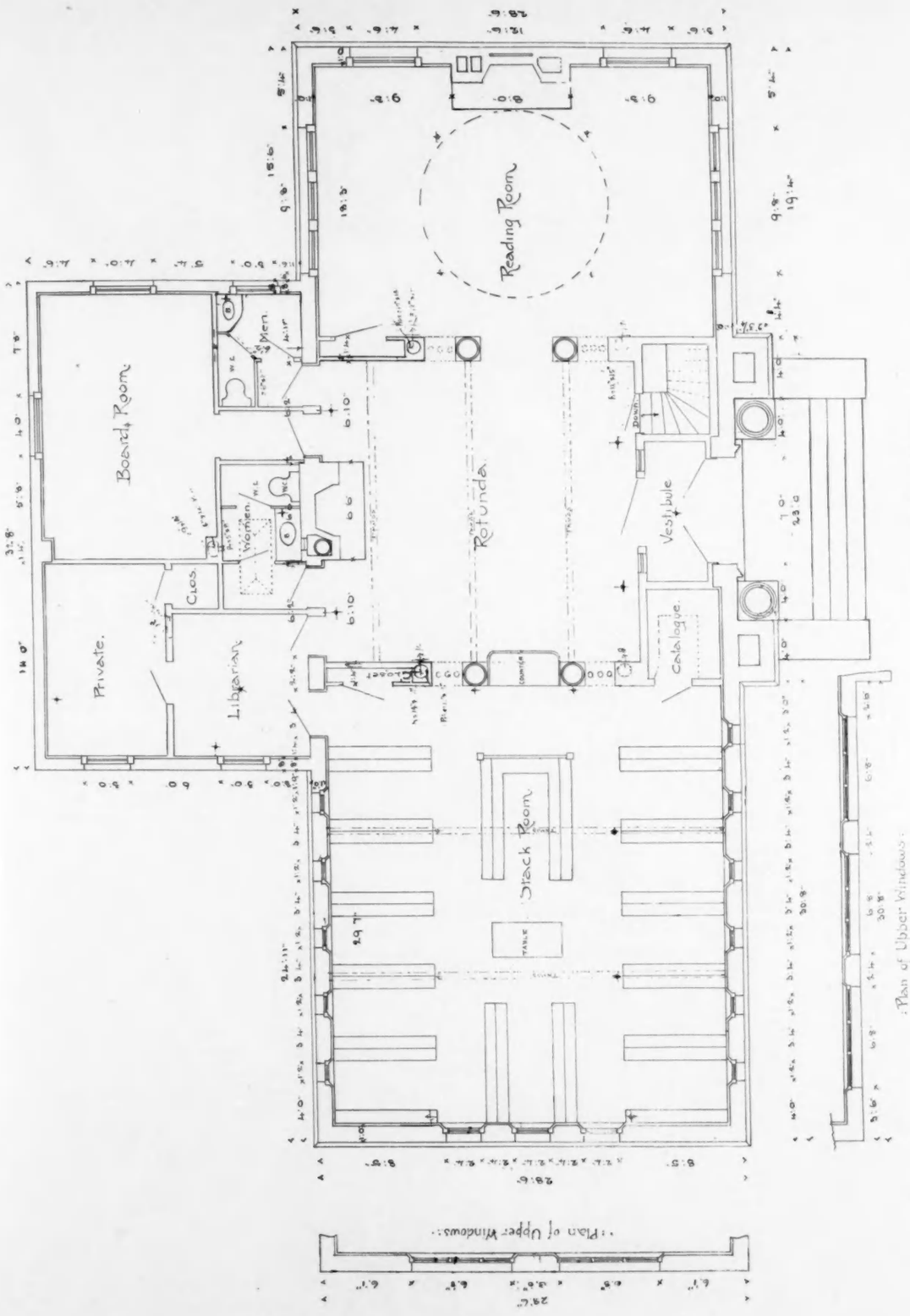
McKIM, MEAD & WHITE Architects.




: Ground Floor Plan. :

: Greenwich Public Library :

LAMB & RICH. ARCHITECTS.

: Plan of Upper Windows :

VOLVME V JUNE 1896 No. 6

# THE BRICKBVILDER

OFFICE 85 WATER STREET BOSTON

## THE BRICKBUILDER.

AN ILLUSTRATED MONTHLY DEVOTED TO THE ADVANCEMENT OF ARCHITECTURE IN MATERIALS OF CLAY.

PUBLISHED BY

The Brickbuilder Publishing Company,

CUSHING BUILDING, 85 WATER STREET, BOSTON.

P. O. BOX 3282.

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| Subscription price, mailed flat to subscribers in the United States and Canada | $2.50 per year |
| Single numbers | 25 cents |
| To countries in the Postal Union | $3.00 per year |

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Entered at the Boston, Mass., Post Office as Second Class Mail Matter, March 12, 1892.

THE BRICKBUILDER is for sale by all Newsdealers in the United States and Canada. Trade Supplied by the American News Co. and its branches.

PUBLISHERS' STATEMENT.

No person, firm, or corporation, interested directly or indirectly in the production or sale of building materials of any sort, has any connections, editorial or proprietary, with this publication.

THE BRICKBUILDER is published the 20th of each month.

THE brick masonry tests made under the direction of the Royal Institute of British Architects, which were described in our last issue, comprise a line of investigation which might be pursued to a considerable extent in this country with great advantage to our manufacturers as well as to our constructors. We are inclined to believe that the safe resistance of brickwork is overestimated in this country. The bricks themselves which are at our disposal are thoroughly first class in every respect, and are amply strong for the duty which is put upon them, but the strength of a brick pier or wall cannot be measured by the strength of the bricks. The mortar which is used in the construction is the weakest element. Consequently, tests of brick piers are, as a matter of fact, tests of mortar joints. It will be noticed, by reference to the British experiments, that the piers began to fail in nearly every case by the mortar crushing out from the joints, and though the bricks themselves were crushed, we cannot call the ultimate resistance of a brick construction any more than the limit of loading without preliminary cracking or crushing. As soon as a pier fails at all, it is worthless. Now the best of mortar will hardly sustain more than 25 or 30 tons per foot. Indeed, we very much doubt whether mortar such as actually goes into a building laid under the conditions which must exist in every commercial structure, would stand over 20 tons without being disintegrated beyond the safety line. And when it comes to the ordinary lime mortars such as are used in some structures, considering farther that brickwork in a building is generally loaded as high at first as it ever is, and that lime mortar has no opportunity to acquire any great degree of hardness inside of a number of months, it does not seem rational to believe that lime mortar under the most favorable conditions would resist more than, say, 10 tons per foot. Consequently, if we are to take even so low a factor of safety as 4, it is not wise to overload brickwork, even of the best description, with more than 5 or 6 tons per foot.

This is a purely theoretical assumption. There are so few practical facts to draw upon, relating to American brick construction, that an argument of this sort is necessarily vague. The tests which have been made heretofore of brick piers, while excellent in their way, have demonstrated the strength of bricks rather than of construction, and it is to be hoped that an opportunity may arise for conducting a set of experiments with our materials; not upon selected piers built by selected workmen with selected materials, but upon ordinary every-day construction such as the architect and the builder has to submit to. We know that very few brick walls are laid properly. We know that the mortar is the vital portion of the structure, because it is the weakest, and yet it is usually slighted or used injudiciously, but it is just such slighted or injudicious work about which we need information.

The thought naturally arises, if our brick piers are not capable of sustaining more than 20 or 25 tons per square foot, why should we object to bricks which do not exceed 60 or 70 tons per foot ultimate resistance? It seems to us the answer to this conundrum is not in the line of resistance to crushing so much as to wear. A soft burned brick, or one which is made of soft material, while undoubtedly amply strong, by comparison with the mortars, to sustain under proper conditions the loads put upon it, will not stand the wear, is more apt to disintegrate in time, and cannot be depended upon for uniformity. A good, first-class brick, either common or face, should show an ultimate resistance of from 750 to 1,000 tons per square foot, if we are to have any confidence in its endurance.

Unfortunately, the opportunity for such tests as were made in London does not exist in this country. The capacity of the Watertown testing machine is 800,000 lbs. The machine which was used in England had a capacity of 1,000,000 lbs., and, to be really conclusive, a machine such as we are referring to should have a capacity of at least 1,500,000, and better yet, 2,000,000 lbs. With the latter capacity it would be possible to crush piers built under ordinary conditions 3 ft. square. A small pier is always proportionately stronger than a large pier, and just as in the testing of beams and columns our scientists have grown to the conviction that it is essential to break full-size sections, and the larger the better, in order to determine the unit resistance, so in order to properly gauge the strength of our masonry, the experiments should be made upon the largest size sections possible. The construction of such a testing machine would involve a great deal of money, but would be well worth while, judged by the probable results.

---

WHEN doctors disagree, it must be expected that laymen shall be of varying mind. To judge by recent New York expressions, the architects there are a unit against high building; but from the columns of the *Inland Architect* comes an opinion on the other side by Mr. Louis H. Sullivan, which certainly has the charm of frank conviction.

"What is the chief characteristic of the tall office building? And at once we answer, it is lofty. This loftiness is to the artist-nature its thrilling aspect. It is the very open organ tone in its

appeal. It must be in turn the dominant chord in his expression of it, the true excitant of his imagination. It must be tall, every inch of it tall. The force and power of altitude must be in it, the glory and pride of exaltation must be in it. It must be every inch a proud and soaring thing, rising in sheer exultation that from bottom to top it is a unit without a single dissenting line — that it is the new, the unexpected, the eloquent peroration of most bald, most sinister, most forbidding conditions.

"The man who designs in this spirit and with this sense of responsibility to the generation he lives in must be no coward, no denier, no bookworm, no dilettante. He must live of his life and for his life in the fullest, most consummate sense. He must realize at once and with the grasp of inspiration that the problem of the tall office building is one of the most stupendous, one of the most magnificent opportunities that the Lord of Nature in His beneficence has ever offered to the proud spirit of man.

"That this has not been perceived — indeed, has been flatly denied — is an exhibition of human perversity that must give us pause."

## ILLUSTRATED ADVERTISEMENTS.

A STRIKING instance of the old régime and the new standing side by side may be seen in the accompanying illustration, which is omitted from the advertisement of the New York Architectural Terra-Cotta Company on page xxviii, for the reason that the design which is published this month (being the one submitted by Will S. Aldrich in the competition recently held by this company, and which took third prize) will not admit of an illustration being made therein.

The modern office building of eleven stories, on the right, stands on the corner of State and Devonshire Streets, with a frontage extending into Washington Street, Boston. The three first stories are stone, and the remaining eight terra-cotta and brick of a bright golden buff, that help to relieve the dulness of this rather somber neighborhood of narrow and winding streets of a bygone time with the comparatively high buildings of to-day. Mr. T. M. Clark, of Boston, is the architect.

To the left is the quaint and unpretentious old brick State House, still in a good state of preservation, on which remains a somewhat unique relic of colonial rule, prior to an episode that is sometimes referred to, and is said to have occurred more than a century ago, in connection with some tea in Boston Harbor.

The adjoining column is one of eight similar ones used on the new City Hall, Elmira, N. Y., now in course of erection. It is of Renaissance design, very rich in detail, and above the first story is executed wholly in gray terra-cotta, with brick made specially to match, both being supplied by The New York Architectural Terra-Cotta Company. The building is exposed on all sides, and when completed promises to be worthy of the city and of its architects, Messrs. Pierce & Bickford, who have achieved a well-deserved distinction among their fellow-citizens.

In the advertisement of Charles T. Harris, lessee, on page xxvi, is illustrated a residence in Chicago, of which Jenny & Mundie are the architects.

The extensive plant of the Sayre-Fisher Company is illustrated in their advertisement on page xvii.

The Hide and Leather Bank Building, New York, is shown in the advertisement of the Clinton Metallic Paint Company, page xxxi,

while an office and store building on Broadway, New York, of which Ralph S. Townsend is the architect, is shown in the advertisement of the New Jersey Terra-Cotta Company, page viii.

Another interesting illustration is that of a Guastavino fireproof floor as used in a large manufacturing building. This may be seen in the advertisement of R. Guastavino, on page xiv.

---

THE furnace for testing columns and their protection erected by the committee appointed to conduct a series of fire-proofing tests in New York City is now completed.

A preliminary test of the furnace and of an unprotected steel column was made recently. Gas heat was used measured by pyrometers of extreme delicacy. Hydraulic pressure was used at the base of the column erected. The tests were entirely satisfactory, and it was expected that the regular tests would begin early in June. At present it is probable that only columns and their protection will be tested, as the furnaces for testing floor arches are not yet finished.

---

THE articles on "Architectural Rendering in Pen and Ink," by Mr. D. A. Gregg, which were begun in the April number of THE BRICKBUILDER, will be continued in later numbers of this year. Through an oversight, "To be continued" was omitted from the end of Mr. Gregg's first article.

---

THREE well-known Boston architects will act as judges in The Barta Press Competition; names to be announced in our July number.

## BRICK PIER TESTS.

EDITORS OF THE BRICKBUILDER.

*Dear Sirs* :— I have just read with much interest the article by Mr. Blackall, on the "Resistance of Brickwork," in the May number of your journal.

I have made a considerable study of the strength of brickwork, and the working loads which I have given in my pocket book are the results of my conclusions on the matter. I believe that 12 tons for Eastern hard burned common brick in cement mortar, and 9 tons for a similar grade of work of Western brick, is as great a resistance as it is safe to depend on, unless unusual precautions are taken to get a first-class job.

If one examines the way in which all the piers tested by the Royal Institute of British Architects failed, and those tested some years ago at the Watertown Arsenal failed in practically the same way, it will be noticed that in most cases failure takes place by the splitting and bulging out of the pier, and not by direct crushing of the brick or mortar, showing that the pier is weakest in the bond and the tensile strength of the brick. From this it would appear that the strength of a brick pier might be materially increased by building into the horizontal joints every few courses, iron clamps, which should turn down at each end, and alternate clamps, laid at right angles to each other. As thorough bonding of the bricks themselves as is possible will also add to the strength of the pier. It would be very interesting if tests could be made of piers built with and without the iron clamps. In regard to New England bricks, and particularly those that used to be made in Cambridge, I have never yet seen bricks that were equal to them in strength and hardness. At the time I made the tests for the Mechanics' Charitable Association of Boston, I found it almost impossible to dress the bricks to parallel surfaces. We first tried a stone-cutter's chisel but there was so much flint in the bricks, that the tool would not cut them. I finally put them on a rubbing bed and faced them in that way, but it took a long time. As to the relative values of mortars, it has always seemed to me that the chief value of cement over lime mortar for brickwork not exposed to dampness lies in the fact that the cement mortar attains its strength much quicker and has greater adhesion to the bricks.

Lime mortar hardens so slowly, that in a four or five story building, built at the rapid rate now customary for business blocks, the mortar in the lower story is comparatively green, even when the walls are topped out, and of course the thicker the walls, the more slowly the mortar hardens.

DENVER, June 2, 1896. F. E. KIDDER.

---

THAT eminent architect, the late Mr. Street, R. A., did more than any one else, in modern times, to further the use of bricks in really grand edifices. During his travels in Italy, he was struck by the simple grandeur of many palatial buildings in that country, which taught him, more than any other object-lesson could possibly do, the fruitful results of utilizing our favorite material. His own works in this country prove how true he was to himself in having bricks specially made whenever he had a large brick building in hand. We would that more architects would follow his example. It is true that a fair amount of bricks, specially designed by the architect, is yet made; but we look to that awakening that must inevitably come, when Street's brickwork shall be appreciated at its full value. — *British Brickbuilder.*

---

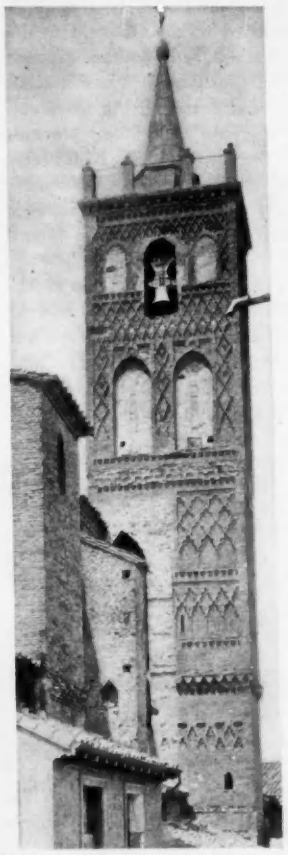
ALL designs intended for The Barta Press Competition should be sent in season to reach this office not later than July 1.

THE names of the prize winners in the Competition will be given in our July number.

THE prizes will be awarded on receipt of the report of the judges.

## Spanish Brick and Tile Work.

BY C. H. BLACKALL.



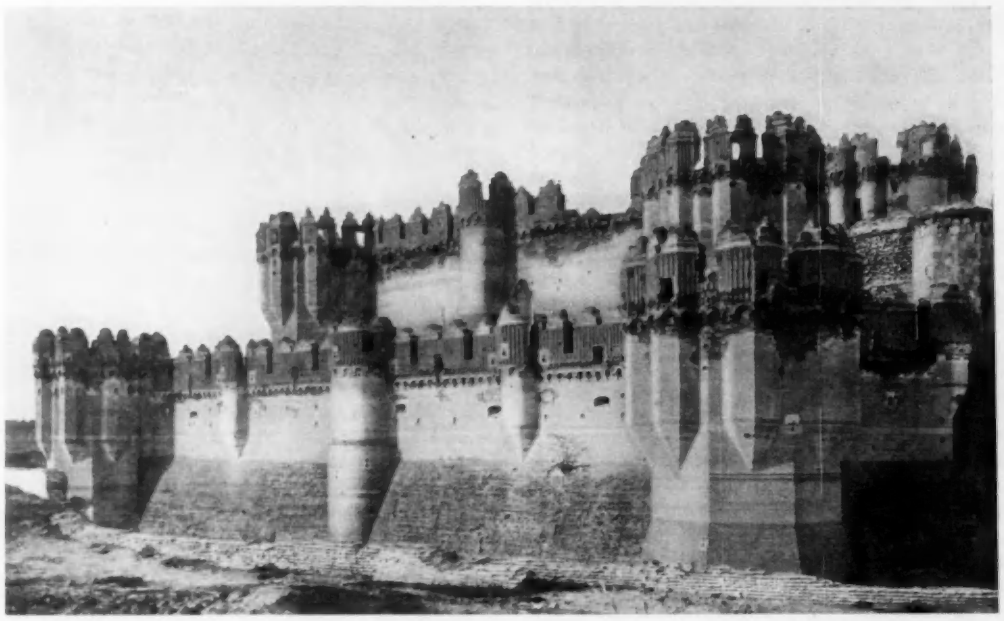
TOWER OF SAN GIL.

BURNT clay in its various modifications has been the most extensively employed material of construction in nearly all times and in all countries, and its use has been followed by some remarkably successful results, notably, such as were evolved on the plains of Lombardy and in the Hanseatic regions of Northwestern Germany. To a lesser extent, also, examples of successful terra-cotta and brickwork are to be found in nearly all countries and accompanying all of the historic styles, from many of which valuable and interesting examples may be drawn for help in our modern architectural needs. This is especially true of Spain, which, while in one sense occupying a secondary position in the ceramic arts, nevertheless affords some most brilliant examples of what may be done with burnt clay.

Brick and terra-cotta work in Spain bears throughout the imprint of being an exotic. The country is peculiarly well endowed with excellent building stones. Nowhere else in the world can there be found a material which will take finish so readily and hold it so firmly as the beautiful, fine-grained, pinkish-yellow sandstone which comes from the neighborhood of Salamanca. Consequently, with ample means at command during its palmiest days, and with the best of stone, marble, and granite to choose from, we do not find a development of the burnt clay arts which might have been expected both by reason of the successful way in which the materials have been handled in some instances, and by the peculiarly adaptive nature of the people themselves, who, stubborn and unyielding as they have been in political matters, have shown a marvelous pliability and extreme powers of assimilation in the imaginative arts. Spain owes the best of her brick and terra-cotta work to an alien race; or, at least, we are accustomed to call the Moors aliens, though a possession of the country for eight centuries,

TOWER OF SAN MIGUEL.

and the evolution of one of the finest types of civilization existing in Europe prior to the Reformation, ought surely to have entitled that gifted people to be classified as peculiarly Spanish. With their expulsion from the peninsula, the use of terra-cotta as a building material began to diminish, being succeeded in historic style by the elaborately tortured stone-work of the Renaissance; but the influence of the Moorish arts in both design and construction was dominant during many subsequent generations, and nearly all the brick and terra-cotta work which is now found in Spain is decidedly Moorish in its character, even when not directly the product of the exiled race. The Arabian arts were essentially decorative; they were never constructive except as an incident, and the decorative tendency is strongly marked even in so constructive a material as brick; but the Moors and their Spanish successors achieved their best successes only when the element of color was incorporated in the brick and terra-cotta designs. The enamels and glazes which the Moors knew how to use so skilfully are without a peer as decorations of architecture. No other people, with the possible exception of some of the Persian tribes, have ever succeeded in so fitly combining bright, vivid color with architecture, and hardly anywhere else in the world do we find color so essential a part of design as in the types of the highest development of Moorish architecture.



CASTLE AT COCA.

In considering the general topic, let us take up first the dryer and less interesting manifestations. The burnt clay products have found many advocates, but few historians. Consequently, chronology plays a slight feature in any record of Spanish work. We know that some buildings are old and some are young. We can tell by inference and appearance which belong to the early Moorish and which to the Renaissance. Beyond this the records are obscure, and it is not worth while to attempt any nice discrimination in periods, but rather to study the actually existing remains by localities. These naturally group themselves in a succession, beginning on the arid plains of the northeasterly portion of Spain, and ending in the vivid coloring of the enameled terra-cottas in the Alhambra.

The oldest examples of Spanish brickwork which possess any architectural pretense are found in the mountainous regions north of Madrid. In the little town of Coca, near Segovia, are the remains of a vast fortress, or Gothic chateau, dating from the fifteenth century. It is to all outward appearance built entirely of brick, but the walls are actually constructed in large part of masses of concrete or coarse rubble, faced with brick. The structure is in a sad state of dilapidation, but enough remains to give a very clear idea of the general design. The walls are heavily machicolated, and a striking result is produced by the use of brick rounded on the edge and laid so as to produce heavy vertical reedings. The appearance of stone trimmings is simulated by bands of stucco, now mostly peeled off. The bricks are of the old Roman pattern, a foot or more square and quite thin, and are laid with very heavy joints. At Medina del Campo, near by, is another structure of the same type, the ancient fortress of the Mota, which is historically of interest as being the place where Queen Isabella died, in 1504. Both of these examples are interesting from their dignified masses and the simple, effective treatment of detail, and recall in many respects the brickwork of the south of France, notably about Albi. A very interesting effect is obtained, possibly by hazard, but which is none the less effective, by the small openings which are left in the walls at frequent intervals, and which were undoubtedly the resting-places for the scaffolding used when the work was erected. This is a treatment which is often found in the later Spanish work, and always counts for a great deal. Every one who has had to do with the designing of brick structures appreciates the advantage of a simple unbroken wall surface, but at the same time, the necessity arises for relieving the monotony of this surface, and in hardly any way can it be accomplished so easily as by this omission of a brick or two at regular intervals. The castles at Medina and at Coca are very much neglected, and apparently little interest is felt in them by the Spanish Government. The bricks used are of a very pale buff color. Neither of these designs offer any of the peculiarities of Moorish architecture, though it is quite probable that both were built by Moors.

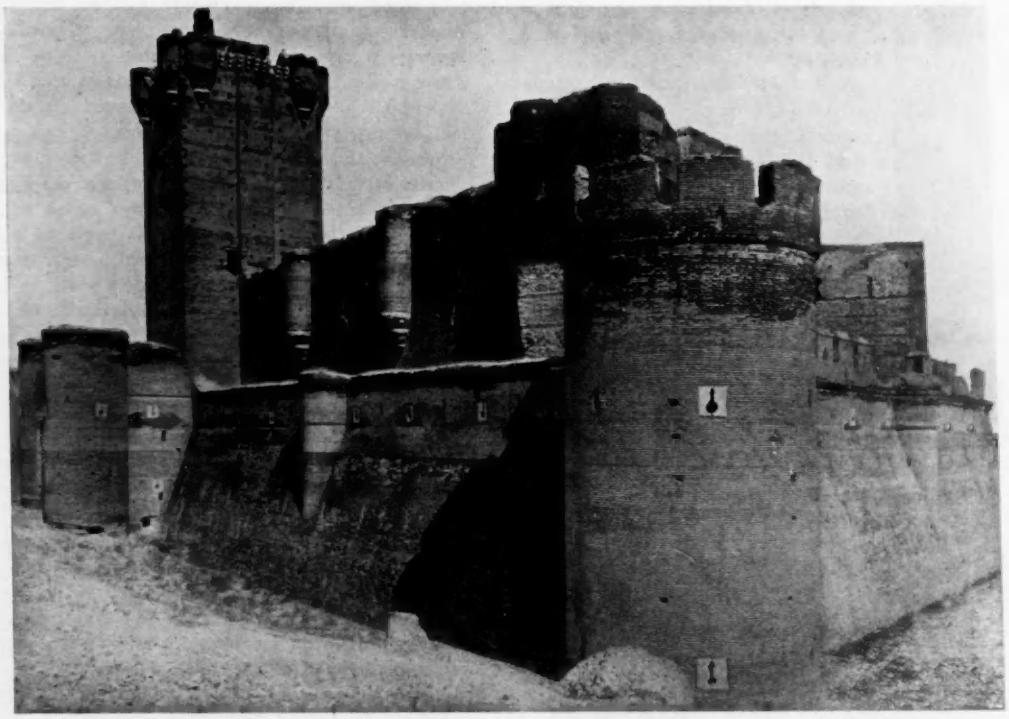
The city of Saragossa contains more interesting brickwork than any other of the Spanish towns. The most prominent structure is the so-called leaning tower, which was built in 1504. It stands entirely isolated in the center of a small square, and reaches to a total height of 276 ft. It measures a little over 40 ft. at the base, is in plan an octagon, and is constructed entirely of brick, but with a variety of forms, ornament, and details, recalling both the Gothic and the Moorish styles. Each story of the tower is treated in a different manner. The basement is simple and massive, and the first story is formed in the plan of a star with reentrant angles. The corner turrets of the upper portion of the tower, the pointed

arched windows, and the picturesque roof, are especial features which mark this tower in an individual manner. There is nothing like it anywhere else in the world, and in many respects it is one of the most successful examples of the use of an humble material to produce a monumental effect. None of the details are helped out by stone or terra-cotta. As in the previous examples, the bricks are of the Roman type, long and flat, and are laid with a very thick bed of mortar. It is intensely interesting to study this design in detail, as we can see how cleverly the effect is obtained with a minimum of effort. The tower leans so as to overhang the base by more than 8 ft. This inclination seems to have been produced deliberately, for at the base it is much less than in the main portion of the tower.

Saragossa is peculiarly rich in brick towers. The one which forms a portion of the church of San Pablo is more markedly Moorish in the character of its detail than the leaning tower, and is much more graceful in its proportions, though not so elaborated or varied in treatment. It is shown in the distance of photograph of the leaning tower. It is octagonal in plan, rising almost unbroken to a height of about 100 ft., above which it is pierced on each of its faces by a pointed mullion window. Above this are bands of diaper work in relief and two tiers of arched openings, with a crowning roof somewhat like that of the leaning tower. The detail could hardly be simpler, and certainly could not be any more effective, judged by the value of the results. The tower of San Gil is still more Moorish in sentiment, but is much more dilapidated than either of the preceding, and is not as picturesque nor as interesting in detail. The same is true also of the tower of San Miguel. The surface treatment of a plain brick wall, which forms so noticeable a feature of the lower portion of this tower, is one of the most effective employments of brick which has ever been devised. It occurs in nearly all of the Hispano Moorish work, and is formed usually of nothing but the simple rectangular bricks, but it has all the effect of a lace mantilla thrown over the surface of the construction and is used with charming effect. The brick used in all of these Saragossa structures is of a pale buff color not particularly pleasing in tone.

It will be noticed that the decoration of all of this work is essentially superficial, and bears no distinct relation to the construction, following in this respect the example of nearly all Arabian art. The leaning tower borrows a slight Gothic sense of constructive ornamentation, but the fretful diaper treatment shows a certain lack of correlation between the treatment of mass and the microscopic conception of detail. It must be admitted, however, that such treatment does really decorate the construction, and, considering the nature of the styles and the materials, these towers are designed very successfully.

The Spanish architects of the early Renaissance or late Gothic period owe very largely to their Moorish predecessors the knack of producing almost infinite variations upon a very simple theme, with the simplest of materials. They seemed never at a loss for a strictly decorative treatment of a plain brick wall, and succeeded in clothing the most commonplace surfaces with interest and variety, using only the single unit brick, which they were able to work into forms and fancies which would be the despair of a modern bricklayer, all the while, however, keeping strictly to a fine appreciation of fitness in both detail, design, and medium. It seems like a contradiction to ascribe color qualities to a construction executed in a single hue; and yet if it be remembered that architecturally color does not mean mere paint, that the color sense may manifest itself in the quality of light and shade, in the harmony of shadow and surface, in the nice balance of relief, and in the appreciative allotment of tone emphasis, these rusty old brick towers assume a color value which appeals very vividly to the artist; though like many other works in which architecture and the imagination are blended, in order to be truly appreciated for their tone qualities, they must be seen in place, with the blue sky and the scorching Spanish sunlight above, and the deep purple, green, and blue shadows flickering like jewels over the dull, tawny surfaces.



CASTILLO DE LA MOTA.

There are two other buildings in Saragossa of a different type, which are hardly less interesting. The structure known as the Lonja, or Exchange (illustration of this was shown in our April number), was erected in 1541. It is constructed entirely of brick with the exception of the cornice, which is of wood. The design is exceedingly dignified, well balanced, and appropriate. The propor-

that was truly British, he decided to make his blocks *solid* throughout. To use his own words, "The necessity for long and hard burning is diminished in proportion as you diminish the body of the clay, by hollowing out the back of the piece and render it to that extent less solid; but here we fall upon another evil almost greater than the first, for it is preeminently unsatisfactory to reduce the ornamental part, or show-side, so to speak, of that block to the condition of a shell, while honest stone or concrete does duty at the back as the real masonry of the building."

We have never been able to see much force in this as an argument, if argument it can be called. We contend that it is not at all a question of sheer solidity of the facing, in a literal sense, or of the solidity of the wall itself, for that matter, but rather the equation of strength, in the composite wall as a whole, built for a specific purpose and under well-considered conditions, irrespective of the number, thickness, or disposition of its components. Beyond this the craving for solidity is entirely one of sentiment, and may be reserved for purely academic uses. As well cavil at the hollow fireproofing, made purposely so for lightness, not calculated to support a concentrated load nor to resist the impact of artillery, but, like Mercutio's wound, "'tis enough, 'twill serve." We use common brick for backing stone and marble, and for building walls that are faced with bricks of a better quality. We accept the mosaics, the inlaid work, and the marble interiors of the Renaissance. But then, such instances as these would not have weighed with Mr. Sharpe — he was a Gothicist. At all events, his example in this particular has never been followed in anything larger than a brick, and even in it some makers stamp a recessed panel, which is valuable (if used) as a mortar bed. A "shell" the average thickness of which is 1½ ins., with cross partitions spaced on 6 in. centers, and honestly welded to the face and sides of the block, has met with a universal concensus of approval. This, as we have pointed out, admits of much larger pieces being made, reduces the otherwise enormous dead weight in the handling, facilitates drying in all its stages, allows the clay to be burned throughout its thickness to the point of vitrifaction, at a much lower temperature, without blowing or serious warping, and when *filled* solid with concrete, produces a block capable of supporting a pressure of 6,000 lbs. per square inch. But the filling in — that is the question, and of it more anon.

The late Captain Fowke was amongst the first to follow the lead of Mr. Sharpe, in an extensive though not altogether judicious use of terra-cotta, at the Museum buildings, Exhibition Road, South Kensington. Then came General Scott, R. E., assisted by Gilbert Redgrave in the erection of the great Albert Hall near by, in which all the main features are executed in this material, including the very effective frieze around the rotunda, which was designed by Edward J. Poynter, R. A. This will recall a similar treatment adopted by General Meigs in the battle scenes and military panorama on the Pension Office, Washington. Mr. Charles Barry also became a convert to and a strenuous advocate of its use, and gave reason for the faith that was in him by adopting it at Dulwich College.

These were noteworthy undertakings, and though in all of them there remained something to be desired architecturally, and much more on the manufacturer's part, yet the shortcomings revealed in them were obviously not insurmountable. They in turn were subjected to keen professional criticism, which, if it did no other good, gave rise to further thought and a fuller inquiry amongst architects. What was equally important, it forced the subject upon the attention of the building public. The general verdict was, on the whole, favorable to its use as a smoke and sulphur-resisting material, produced at reasonable cost, but susceptible of much improvement. Architects made some creditable attempts to adapt their designs to the exigencies of manufacture, and manufacturers in turn hastened to adopt improved methods of production, all of which were based upon a candid enough avowal of existing defects. That *chef-d'œuvre* — the Natural History Museum — that followed was the highly encouraging result of this reciprocal movement.

Architecturally considered, this great edifice added new honors to the long list of those already well won and as modestly worn by Alfred Waterhouse, R. A., whose fertile but well-balanced brain has enriched the Victorian era with so many creations of real beauty, obtained in all cases without any sacrifice of their utility. Being a work of national importance, the material to be used was from its first inception a vital question; and the one finally agreed upon was accepted as the result of very mature consideration. It had won the stamp of approval from an architect of the highest eminence, and a man in whose judgment the public had already learned to repose implicit confidence. These were a sufficient passport to popular favor, and so reassuring that even the icy conservatism of his professional brethren began to melt under their influence. The merit of the material, as well as of the building, when completed in 1878, could not be gainsaid, and the most skeptical among the fraternity were furnished with an orthodox precedent for its employment. It was seen to possess immediate worth and unlimited possibilities, and from that time onward it received more respectful consideration, until at length accorded its rightful place in the specifications of a vast majority of architects.

NATURAL HISTORY MUSEUM, LONDON.

In point of style and general treatment we would take leave to define this building as Waterhouse Normanesque, a term that has not yet found a place in the glossaries, but it is the only one that to our mind conveys an exact idea of its main characteristics. It is erected on the site of the exhibition of 1862, has a frontage of 172 ft. on Cromwell Road, from which fashionable thoroughfare it stands back about 100 ft. The whole of the exterior is terra-cotta in two colors, buff and gray, no bricks appearing save in the internal courts for light and air. The same applies to the interior and all the galleries, where these two colors are agreeably blended without once producing a pattern that is garish or aggressive. In the mere display of ornament this building is not as costly as the British purse could buy. It is "rich, not gaudy." The subjects are well chosen, possess undoubted artistic merit, and are distributed with thoughtful discrimination. We say this in passing for the benefit of those whom it may concern, notably, some of our own exuberant "designers" of detail, who cannot refrain from putting in all they know, and perhaps a little more. In stone, the vital question of cost exercises a wholesome restraint upon their youthful, not to say effeminate, weakness for over-ornamentation. But they will revel in the plasticity of burned clay, until every inch of surface is bedizened with easily repeated forms, and the tired optic as a last resource seeks relief in the prevailing monotony, and rest in utter forgetfulness of the whole affair. In a similar building, intended for other purposes, the ornament would, no doubt, have been governed by Norman, or late Romanesque precedents, as it has been in the case of purely architectural forms. But in a natural history museum it is becomingly

LEANING TOWER, SARAGOSSA.

tioning of the masses, especially the upper arcade of windows, is very satisfactory, and the cornice, though not strictly within the scope of this notice, is so admirably fitted to the general design that it must be considered as the equivalent of terra-cotta work. The Spanish architects, with a few notable exceptions, cared very little for fitness in the choice of material; form, color, mass, and proportion counted for everything, and whether a design was carried out in brick, stone, or wood was a matter purely of constructive or pecuniary detail with them. Consequently we find many buildings which, according to our present standpoints, are strongly suggestive of brick and terra-cotta work, whereas they are really constructed of stone, and, in some instances, as in the Lonja, wood was used probably for reasons of economy, but the spirit of the design is altogether that of terra-cotta work.

A similar structure is the ancient palace which is now occupied by the representatives of the government, the Real Audiencia. This is only in part of brick; the lower portion is of stone; but the more interesting portion of the design is constructed after the style of the Lonja. The older building is essentially Roman in style; that is to say, the general appearance of the structure, especially the cornice and the upper row of windows, recalls the structures which the Romans left as traces of their progress in various parts of Europe. The motive of the upper portion of the Audiencia, on the other hand, is essentially Spanish, namely, a short, square tower at each end of the building, denominating, but continuing the lines of a long arcade.

(*To be continued.*)

REAL AUDIENCIA, SARAGOSSA.

## ARCHITECTURAL TERRA-COTTA.

BY THOMAS CUSACK. — (*Continued.*)

AS a direct consequence of Mr. Sharpe's success with his first venture in the manipulation of fire-clay to meet the requirements of Gothic architecture at Lever Bridge, he was soon afterwards requested to duplicate it, but on a larger scale. This he did in a church built in the township of Rusholme, now part of the city of Manchester, and of it we cannot do better than quote his own description: "The plan that I adopted for this church was of more medieval type than that of Lever Bridge, determined as I was to prove that, even in these comparatively parsimonious days, it was possible to reproduce, in this ductile material, a genuine example of the true Lincolnshire type of the fourteenth century, without stint as to the nature of the molded and carved work with which its main features should be clothed. It has clustered piers, floriated pier capitals, and molded pier arches. It has a large five-light east window of flowing tracery, a diapered parapet to the aisle and clear-story walls, and a tower and spire 170 ft. high. The whole of the exterior is of terra-cotta, the coursed walling being of 5 in. blocks, as at Lever Bridge."

Many years after this (in 1874), having, in the meantime, retired from active practise, he was the principal contributor to and the honorary architect of yet another church, erected near his own residence at Scotforth. His faith in the use of terra-cotta remained unshaken, and, for the third time, he adopted it in the building of this, and, we regret to add, his last church. This time, however, he reverted to an earlier style — that of the transitional period towards the end of the twelfth century, when from the lighter examples of Norman, the first suggestions of early English were being evolved. This serves to show what a practical insight he had obtained into the true character of the material which he proposed to use. For, notwithstanding the undoubted mastery which in recent years has been gained in every process of its manufacture, this is in some respects, and perhaps above all others, the style best adapted to a free use of molded and oft-repeated forms, whether looked at from an architectural or from a purely economic point of view.*

The experience which he had already gained, and for which he had no doubt paid the usual high price, was turned to profitable account in the work of the second and third churches. Roundabout methods were discarded, and such errors of judgment as had been committed were, let us hope, not again repeated. Having outlined his design, he set about detailing it, and that done, he himself made the working drawings to shrinkage scale. In this case he jointed his work in much smaller pieces, and so arranged the joints that they would become an integral and by no means undesirable feature of the design. He had not been allowed to forget that he was using a refractory fire-clay, which, to be durable, had of necessity to be burned in an open fire, at a most intense heat, and the kiln sustained on full fire for several days. The comparatively small pieces — an average of 400 cu. ins. — into which he jointed his work enabled him to do this without incurring serious warping or distortion. This, in principle, was no doubt an improvement, but we think it was carried too far in the inordinately small blocks which he had fixed as a maximum. They were rather less than one sixtieth of the size which is now frequently made with perfect safety in drying and burning. Blocks containing 14 cu. ft. and weighing, when burned, 1,000 lbs., are not considered too large, provided they be anything like a convenient shape. We have seen pieces containing 17 cu. ft. turned out successfully, while blocks of from 7 to 10 cu. ft. are advantageous and indeed desirable sizes from a manufacturing standpoint, subject to the qualification already noted.

He did make one retrograde step, however, and though prompted by the best intentions, it was none the less a mistaken notion. With an aversion to shams that cannot be too highly commended in an architect, and should be prized by everybody, if only on account of its rarity, together with an unconquerable belief in absolute solidity

*I hope to illustrate these churches at an early date. — T. C.

# Fire-proofing Department.

Conducted in the Interest of Building Construction to Prevent Loss by Fire.

## FIRE-PROOF FLOOR ARCHES.

BY GEO. HILL, C. E. (*Continued.*)

### CLAY ARCH TESTS.

*Test No. 84.*— This was of an end-construction arch similar to Test No. 83, and shown in Fig. 35. At 5,000 lbs. cracks appeared at the bottom on the right-hand side of the key. At 10,000 lbs.

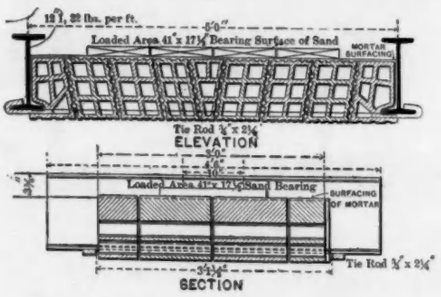



FIG. 36.

these cracks opened ⅛ in.; the top surface bulged up. At 12,500 lbs. the cracks at the bottom of the key opened ¼ in.; cracks appeared between the skew-back block and the skew-back beam along the left-hand end, and a crack also appeared along the left-hand end in the skew and the first voussoir just above the bottom fillet of the web of the skew-back beam, as shown in Fig. 42. This skew then crushed off over the whole bottom, and the facing plaster dropped off from the top. The maximum load was 13,000 lbs. The key was cracked along the top cover plate, and the skew was a splintered mass.

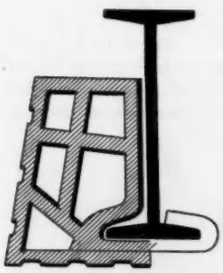


FIG. 37.

*Test No. 85.*— This was of a side-construction arch of the section shown in Fig. 36, with the load applied over an area of 41 by 17½ ins. The effective depth of the arch was 7½ ins., and there was a leveling of mortar on the top. The key course was quite high in the center, so that the load was applied almost directly on it. The course next west of it was also a little high. At 5,000 lbs. a crack opened at the bottom

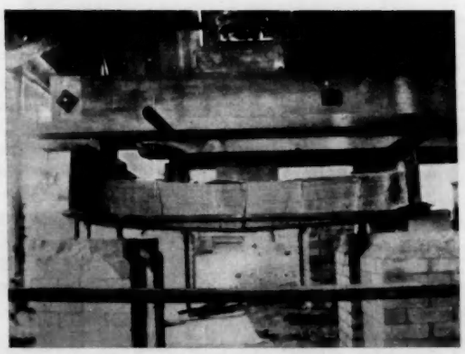


FIG. 41.

FIG. 42.

of the key on the left-hand side about $\frac{1}{16}$ in. At 10,000 lbs. failure occurred at the top of the voussoir, the third one from the left-hand skew-back, or the second one from the key. All through that course

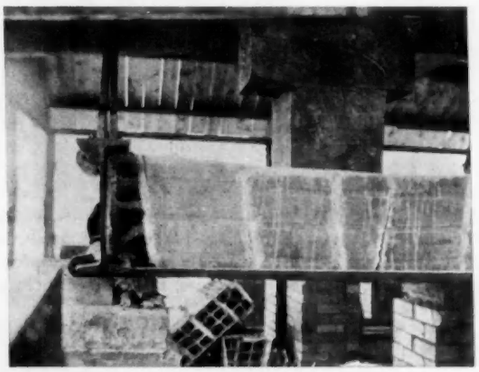


FIG. 43.

there was a crushing of the top web. The flange protection of the skew-back also sheared off.

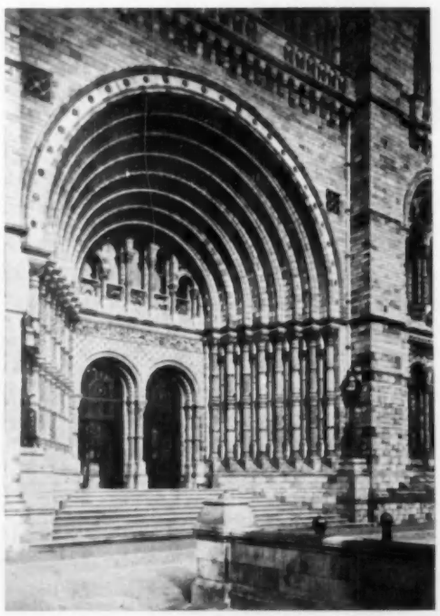
*Test No. 86.*— This was of a side-construction arch with a simi-

FIG. 44.

lar loading, namely, 17½ by 41 ins. The skew-back of this arch is shown in Fig. 37, the remaining details are indicated in Fig. 36. At

naturalesque, extinct and actual life being the two sources from which it was drawn. It has been conventionalized in part and to some extent, but so deftly has this been done, that one is at first sight beguiled into a comparison between the creatures of sea and land, placed in the cases, and those more enduringly depicted on the walls of the building. The monkeys that climb up the piers and salient angles with so firm a clutch suggest the presence of once living wearers of the prehensile tail, placed on exhibition, but the work of the modeler does not everywhere enter into competition with that of the taxidermist.

In the matter of construction, the blocks of terra-cotta are solidly built, with alternate long and short bond, similar in all respects to the best masonry. In this, as in a good many other things, it is in strong contrast to our growing tendency to veneer, without any bond whatever, save that "weak invention of the enemy" called wire bond, reinforced by occasional alleged anchors, inserted at the option of a more or less worthy body of men known as "lumpers," to whom the labor is usually sublet by a middleman, who calls himself general contractor. In the work under notice, every block was soaked in a tank of clean water, which served a double purpose; first, the natural suction being thus neutralized, sufficient moisture is allowed to remain in the cement while setting and during the process of crystallization. Second, the vacuum that nature abhors, but which must for a time exist in work that has passed through 2,000 degs. Fahr., being filled with *clean* water, there is no room left for absorption of the impure and discolored water from the mortar to stain the surface of the work, perhaps permanently, and certain to promote temporary vegetation. The chambers were all filled solid with concrete before being hoisted, so that the men on top had no option but to set them true on a good mortar bed, filling the vertical joints and grouting all interstices at every course. Not only was this specified; what was far more to the purpose, experienced and trustworthy representatives of the architect were in constant attendance to see that what was on paper was duly carried out in letter and in spirit during all stages of



ENTRANCE NATURAL HISTORY MUSEUM, LONDON.

the work. Our plan of building in hollow boxes, or, at best, making a pretense of pushing in a few bricks when backing up, setting the work so close that no room is left for any mortar in the vertical joints except a lick and a promise, smeared on the outer edges, pointing up for the sake of appearance, and then, of course, "going ahead," can hardly be claimed as an improvement. The work itself, as made by our best firms, is quite as true to line, as well modeled, as accurately fitted — and this we say advisedly — of far more even

VIEW OF INDEX MUSEUM, NATURAL HISTORY MUSEUM, LONDON.

color, than any yet made in England. As a general rule, however, it suffers, and that most lamentably, in the setting. The manufacturers, and such of their men as take any real pride in their work, look on in dismay and indulge in various forms of regret, all of which are in vain; but beyond this they have little, if any, control under present anomalous conditions. We have data, enough and to spare, for these statements, but should any one suffering from a good fitting cap think that such "comparisons are odious," we reply that they ought to be edifying. In words from the same undisputed master of English, they may "pardon what I have spoke, for 'tis a studied, not a passing thought, by duty ruminated."

Taken for all in all, this one building in not only the most homogeneous, but by far the most complete and satisfactory example of purely architectural terra-cotta that any age or nation has yet produced. Granted the exceptional opportunities placed at the architect's disposal in the way of magnitude and financial means. Similar conditions have existed more than once during the last quarter of a century, and though the mountain labored and brought forth something bigger than a mouse, in no case has the outcome been worthy of comparison. Alfred Waterhouse alone was fully equal to the occasion, and his work stands to-day an unrivaled masterpiece. Twenty years have elapsed since his conception became realized. It is but one of the many projects of equal and even greater magnitude conceived and executed during the years of his prime, and by which he had ere then achieved a national reputation. On it, but not upon it alone, he bestowed the best efforts of a mind ripe in experience.

Since that time he has grown in honors, as in years, yet found no reason to recant his earlier conclusions, or to regret his choice in the use made of this material. On the contrary, he has never ceased to urge its many claims to acceptance, and never once neglected a suitable opportunity to lead the way in its continued use. Therefore, if not the father of modern terra-cotta throughout the English-speaking world, he has been to it a potent and unflinching godfather, and as such we would respectfully salute him.

*(To be continued.)*

5,000 lbs. a crack appeared on the left-hand side of the key at the bottom, and at 12,500 lbs. the top cover began to break up, while failure occurred at 14,500 lbs., the web along the voussoirs next to

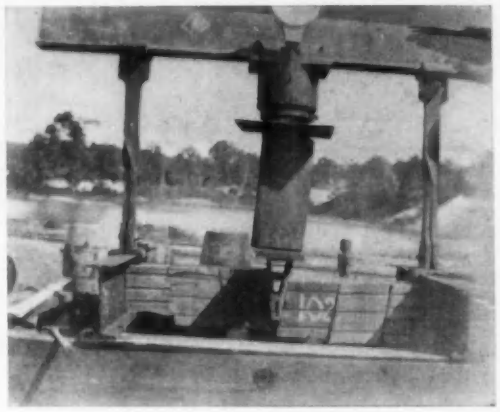


FIG. 45.

the skew-backs at the left-hand end shearing all across and directly down. The effective rise of this arch was 8 ins.

*Test No. 87.*— This was of an end-construction arch nominally 12 ins. deep, having an effective rise of 10 ins., and with a side-construction skew-back of hard tile, shown in Fig. 43. At 3,750 lbs., reached in one minute, a hair crack appeared on the right hand side of the key, and showed through to the other face. At 7,500 lbs., reached in 2.5 minutes, the skew-back began to show failure at both sides. At 10,000 lbs. no change took place. At 11,250 lbs. reached in 4 minutes, the arch again began to fail at the skew-backs, and the crack next to the key at the bottom opened $\frac{1}{16}$ in. At 15,000 lbs., reached in 13.2 minutes, the cracks showed all along the skew-back joints on both sides. At 16,400 lbs., reached in 14.3 minutes, the arch failed, the top surface cracking, a slight crack appearing in the top cover of the key, and the skews cracking off just below the diagonally inclined piece on both sides, the bottom cover piece falling off (Fig. 43).

*Test No. 88.*— This was of an end-construction arch, similar to that shown in Fig. 35, except the skew-backs, which are shown in Fig. 41, and were of the porous terra-cotta solid type; the effective rise was 7 ins., and there was a slight finish of mortar on top. The load was applied on an area of 10 by 13 ins. At 2,500 lbs., after 1 minute loading, a hair crack appeared on the right-hand side of the bottom key. At 5,000 lbs., after 1.5 minutes, a crack appeared on the east skew-back by the block moving away from its beam; at 6,500 lbs., after 2 minutes, the crack at the bottom of the key widened to $\frac{1}{16}$ in.; at 7,250 lbs., after 2.3 minutes, the left-hand skew-back cracked on the top away from the first voussoir; at 8,000 lbs. the same thing happened with the right-hand skew; at 9,000 lbs. after 3 minutes, the cement cover on top of the key began to rise away from the surface. At 10,000 lbs. this began to crack over the top of the key; at 12,000 lbs. the left-hand skew-back began to crack where the lower hole went through it. At 12,500 lbs. the top surface on the key cracked very badly, and the cracks at the skew-backs

FIG. 46.

opened ¼ in. each. At 13,500 lbs., after 5.5 minutes, the key at the bottom cracked open ¾ in. and the bottom plaster began to fall out, and at failure the point of the left-hand skew sheared off, the key cracked through the middle, near the top section opening about ½

TABLE NO. 4.— DATA OF CLAY ARCH TESTS.

| Test Number. | Span. Inches. | Rise. Inches. | Width. Inches. | Total Arch Area. Square Feet. | Loaded Arch Area. Square Feet. | Total Load. Pounds. | Load per Square Foot of Arch. Pounds. | Load per Square Foot Loaded. Pounds. | Area Tie-rod. Square Inches. | Horizontal Thrust. Pounds. | Shear per Foot Skew. Pounds. | Depth of Skew. Inches. | Blocks. Style. | Blocks. Material. | Blocks. Skew. | Load. | Remarks. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 76 | 46 | 5 | 11.5 | 3.67 | 2.88 | 9 000 | 2 455 | 3 125 | 1.57 | 10 340 | 4 670 | 7.5 | End | Hard..... | Protection | Distributed. | Failed on arch lines. |
| 77 | 46 | 5.5 | 11.5 | 3.67 | 2.88 | 2 500 | 682 | 868 | 1.57 | 2 615 | 1 303 | 8 | Side | Hard..... | Protection | Distributed. | Sheared. Laid dry. |
| 78 | 45 | 8 | 11.5 | 3.62 | 2.88 | 1 300 | 359 | 452 | 1.57 | 1 464 | 678 | 8 | Side | Hard..... | Protection | Distributed. | Sheared. Laid dry. |
| 79 | 60 | 3.5 | 48 | 20.00 | 3.00 | 13 750 | 688 | 4 590 | 1.57 | 24 500 | 1 720 | 6 | End | Hard..... | Protection | Distributed. | Crushed on arch lines. Old arch in Portland cement. |
| 80 | 65 | 6 | 50 | 22.6 | 20 | 57 500 | 2 545 | 2 875 | 3.52 | 78 000 | 6 980 | 10 | End | Hard..... | Plain..... | Distributed. | Unbroken. Laid in Portland and frozen. |
| 81 | 60 | 6 | 36 | 15 | 0.82 | 10 000 | 668 | 12 200 | 3.38 | 25 000 | 1 670 | 8 | Side | Hard..... | Plain..... | Center..... | Sheared by edge of load. Portland. |
| 82 | 60 | 5 | 36 | 15 | 4.98 | 5 700 | 381 | 1 143 | 3.38 | 8 550 | 950 | 8 | Side | Hard..... | Protection | Distributed. | Sheared by skew-back. Portland. |
| 83 | 60 | 5 | 35.2 | 14.7 | 0.88 | 11 250 | 767 | 12 800 | 3.38 | 33 750 | 1 890 | 7.5 | End | Hard..... | Protection | Center..... | Crushed porous terra-cotta skew. Portland. |
| 84 | 60 | 5 | 36.5 | 15.2 | 0.88 | 13 000 | 857 | 14 800 | 3.38 | 39 000 | 2 135 | 7.5 | End | Porous T. C. | Protection | Center..... | Crushed porous terra-cotta skew. Portland. |
| 85 | 60 | 7.5 | 36 | 15 | 4.98 | 13 500 | 900 | 2 710 | 3.38 | 13 500 | 2 250 | 10 | Side | Hard..... | Protection | Distributed. | Crushed on top by key. Portland. |
| 86 | 60 | 8 | 37 | 15.4 | 4.98 | 14 500 | 943 | 2 915 | 3.38 | 13 600 | 2 360 | 10 | Side | Hard..... | Plain..... | Distributed. | ..... |
| 87 | 60 | 10 | 41 | 17.1 | 0.88 | 16 400 | 960 | 18 670 | 3.38 | 24 600 | 2 395 | 12 | End | Hard..... | Plain..... | Center..... | Side skew. Skew failed. Portland. |
| 88 | 60 | 7 | 38.25 | 15.8 | 0.88 | 14 500 | 919 | 16 500 | 3.38 | 31 100 | 2 290 | 8 | End | Porous T. C. | Plain..... | Center..... | Porous T. C. Skew. Portland. |
| 89 | 60 | 7 | 38.25 | 15.8 | 0.88 | 15 750 | 997 | 17 900 | 10.14 | 33 800 | 2 480 | 8 | End | Hard..... | Plain..... | Center..... | Porous T. C. Skew. |
| 90 | 60 | 8.75 | 10 | 4.2 | 0.82 | 3 100 | 739 | 3 780 | 10.14 | 5 320 | 1 890 | 12 | End | Hard..... | Protection | Center..... | End skew, side key. No mortar. |
| 91 | 60 | 9 | 10 | 4.2 | 0.82 | 5 000 | 1 190 | 6 100 | 10.14 | 8 350 | 3 050 | 12 | End | Hard..... | Protection | Center..... | All end. No mortar. |
| 92 | 60 | 5 | 12 | 5 | 1.00 | 3 500 | 654 | 3 500 | 10.14 | 10 500 | 1 750 | 8 | Side | Hard..... | Protection | Distributed. | No mortar. |
| 93 | 60 | 5.5 | 12 | 5 | 4.0 | 10 000 | 2 000 | 2 500 | 10.14 | 13 640 | 5 000 | 8 | Side | Hard..... | Plain..... | Distributed. | No mortar. |
| 94 | 60 | 9 | 10 | 4.16 | 3.35 | 15 100 | 3 630 | 4 510 | 10.14 | 12 560 | 9 210 | 12 | End | Hard..... | Protection | Distributed. | Deflection 1½ inches by crushing in. No mortar. |
| 95 | 60 | 9.5 | 10 | 4.16 | 1.00 | 2 500 | 601 | 2 500 | 10.14 | 3 950 | 1 525 | 12 | End | Hard..... | Protection | Center..... | ..... |
| 96 | 60 | 9.5 | 10 | 4.16 | 1.00 | 3 000 | 723 | 3 000 | 10.14 | 3 980 | 2 400 | 12 | End | Hard..... | Protection | Eccentric... | 18 inches from W. skew-back beam. No mortar. |
| 97 | 60 | 5.5 | 12 | 5.0 | 1.00 | 1 500 | 300 | 1 500 | 10.14 | 3 440 | 1 750 | 8 | Side | Hard..... | Plain..... | Eccentric... | 18 inches from W. skew-back beam. No mortar. |
| 98 | 60 | 5.5 | 12 | 5.00 | 1.00 | 2 500 | 500 | 2 500 | 10.14 | 6 850 | 1 250 | 8 | Side | Hard..... | Plain..... | Center..... | ..... |
| 99 | 60 | 5.5 | 24 | 10 | 6.00 | 9 950 | 995 | 1 658 | 10.14 | 22 650 | 2 486 | 8 | Side | Hard..... | Plain..... | Distributed. | Two blocks wide. No mortar. |
| 100 | 60 | 5.5 | 24 | 10 | 2 | 2 500 | 250 | 1 250 | 10.14 | 6 820 | 625 | 8 | Side | Hard..... | Plain..... | Center..... | Two blocks wide. No mortar. |
| 101 | 60 | 5.5 | 24 | 10 | 2 | 2 750 | 275 | 1 375 | 10.14 | 7 190 | 1 100 | 8 | Side | Hard..... | Plain..... | Eccentric... | Two blocks wide. 18 inches from W. beam. No mortar. |

in., and near the bottom section a crack opened that was just perceptible.

*Test No. 89.* — This arch was similar to the last. At 2,250 lbs. a crack opened on the right-hand side of the bottom key; at 10,000

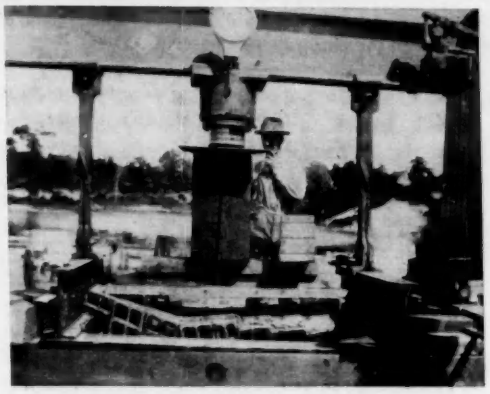


FIG. 47.

lbs. this crack opened $\frac{1}{32}$ in.; the top surface of mortar began to spall up. Cracks appeared between the skew and the first voussoir on the left-hand side. At 13,000 lbs. the crack in the bottom of the key opened $\frac{1}{8}$ in., and the cement cover began rising on top in the center. At 15,000 lbs., after four minutes, the crack at the center began to spall, the plaster began falling off at the bottom, and the key began to splinter. When failure occurred the arch was all splintered on the top, and when the top was taken off it was found to have cracked along the line of the arch thrust. The maximum load was 15,750 lbs. The left-hand skew cracked between the two holes, shearing out and dropping off. The first voussoir from the right-hand skew had the bottom plate sheared off entirely, all of the cracks showing the true arch action.

All of the following tests were made with hard tile arches laid

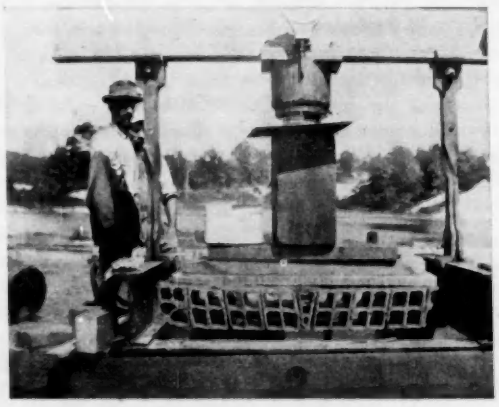


FIG. 48.

up without any mortar. A little damp sand was used to bed the skew-backs of the side-construction arches and to even up the top for the first plank. They were all built between the same pair of beams and usually sagged a little after the center was struck.

*Test No. 90.* — This was of a hard tile end-construction arch, with a side-construction key, the load being placed as shown in Fig. 44, on the top of the key. Immediately on the loading being started, there was a pinching in of the key and cracking at the point where the top of the voussoirs struck it; but the key section of $\frac{3}{4}$ in. material stood under the vertical load until a maximum of 3,100 lbs. was reached after 2.2 minutes. Data concerning this arch is given in Table No. 4. After failure the arch looked as in Fig. 45.

*Test No. 91.* — This arch was 12 in. end-construction protection-skew hard tile; the key block had the corners chipped out as shown in Fig. 46; the left skew was the only one that failed; the right-hand voussoir, which had the numbering on, cracked on top as shown. The maximum load of 5,000 lbs. was reached in 2.2 minutes.

*Test No. 92.* — This arch was of the side-construction protection-skew hard tile block type, and failed under a distributed load made as shown in Fig. 47, which also shows the manner of the failure. The only block which failed was the left-hand skew, which sheared off by reason of the thrust of the diagonal piece, not being supported by the flange of the beam. The maximum pressure in this case, 3,500 lbs., was reached in 4 minutes.

*Test No. 93.* — This arch was built of the same voussoir blocks as Test No. 92, with a new key block and with plain skew-backs, as shown in Fig. 48. The result was that the arch carried a load of 10,000 lbs., and, when failure occurred, the left-hand skew broke all to pieces.

*Test No. 94.* — This arch was of the 12 in. end-construction hard tile protection-skew type, loaded over 10 minutes, and maximum be-

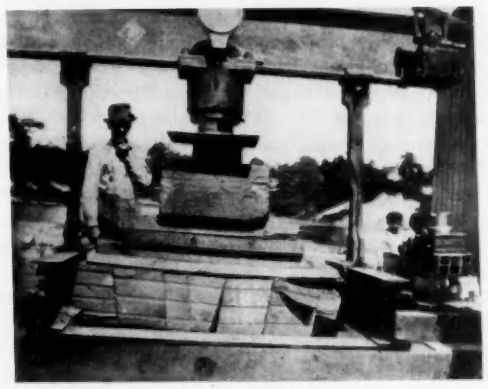


FIG. 49.

ing reached at 4.5 minutes; the crown deflected about 1½ ins., due to the crushing in of the material. At the beginning the joint at the bottom of the key was open ¾ in. On the side opposite to that shown in Fig. 49, it was practically intact, and, at the time the photograph was taken from which the cut was made, the arch was carrying over 8,000 lbs.

*Test No. 95.* — This was of a 12 in. end-construction hard tile

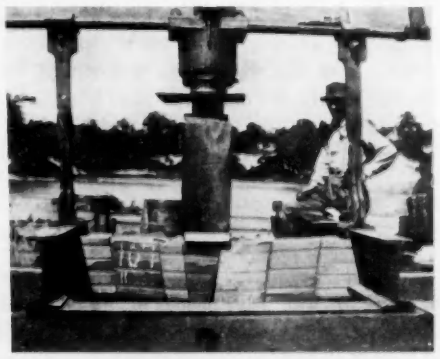


FIG. 50.

arch, which began to spall on the top at 2,250 lbs.; the west or left-hand skew split at 2,500 lbs., and the voussoir at the right-hand side of the key split at the top. This arch is shown in Fig. 50 after failure.

(*To be continued.*)

# Mortars and Concrete Department.

Devoted to Advanced Methods of using Cements and Limes in Building Construction.

## AMERICAN CEMENT.

BY URIAH CUMMINGS.

### CHAPTER VI. (*Concluded.*)

### THE CHEMISTRY OF CEMENTS.

IT will be observed that, in the matter of proportions, this cement was as nearly perfect as it was possible to be made. It was tested frequently by the author for many years, and it was never known to check or expand, and it became exceedingly hard and permanent in masonry, and was used in sidewalks and similar work, almost to the exclusion of all other brands, and yet it would rarely exceed 250 lbs. in a seven days' test. Neither did it become glassy and brittle with age, like the modern Portland cements, a result due entirely to the demand for higher short time tests; a demand which, to the detriment of its quality, has compelled the manufacturers of the brand in question to increase the proportion of lime, as may be seen by reference to No. 10 of the table of analyses, in which it will be observed that the ratio of silica to lime is as 1 to 3.07, while the ratio in the earlier analysis as herein given is 1 to 1.85+, which is practically the true combining ratio, *i. e.*, 1 to 1.86+.

The new ratio which is sought to be established is best shown by the formula $3CaO.SiO_2$, while that for the long accepted ratio is $2CaO.SiO_2$. These two formulas, reduced to percentages, are given in the order named.

| | | | |
|---|---|---|---|
| Silica | 26.38 | Silica | 34.91 |
| Lime | 73.62 | Lime | 65.09 |
| Totals | 100.00 | | 100.00 |

There is no simpler way to demonstrate by practical experiment which of the two formulas comes the nearest to actual facts, than by mixing together clay and gypsum, with the latter in excess, and calcining to a white heat. The amount of sulphate of lime remaining will determine the amount of lime that has combined with a given amount of silica.

Such experiments made under the direction of the author demonstrated very clearly that the correct ratio is not in accord with the modern theory that 3 molecules of lime combine with 1 of silica.

It is well known that if we calcine 100 pounds of gypsum to a white heat, the only change which is effected is the expulsion of the water of crystallization, amounting to 20.93 per cent. of the total weight, leaving 79.07 sulphate of lime, which is composed of lime 32.55 and sulphuric acid 46.52.

If, however, the 100 pounds of pure gypsum are finely ground and thoroughly mixed with 23.27 pounds of dry clay, composed of silica 17.45 and alumina 5.82 = 23.27 clay, the composition in hundred parts will be as follows: —

| | | |
|---|---|---|
| Sulphuric acid | 37.74 | = 81.12 gypsum. |
| Lime | 26.40 | |
| Water | 16.98 | |
| Silica | 14.15 | |
| Alumina | 4.73 | |
| Total | 100.00 | |

If this mixture is then calcined to a white heat, the water of the gypsum will first be expelled, and when the high heat is reached, the silicic acid will expel the sulphuric acid and itself combine with the lime and alumina, forming an hydraulic cement pure and simple, the analysis of which will appear in column No. 1 of the following table, the succeeding columns exhibiting the amount and kind of silicates contained therein.

| No. | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| Silica | 31.25 | — 18.44 = | 12.81 | — 12.81 = | 00.00 |
| Lime | 58.30 | — 34.39 = | 23.91 | — 23.88 = | 00.03 |
| Alumina | 10.45 | — 10.45 = | 00.00 | — 00.00 = | 00.00 |
| Totals | 100.00 | 63.28 | | 36.69 | 00.03 |

| | |
|---|---|
| Silicate of lime and alumina | 63.28 |
| Silicate of lime | 36.69 |
| Total silicates | 99.97 |
| Total free base | 0.03 |
| Total | 100.00 |

It will here be seen that, the silica being present in full combining proportions with the lime, the sulphuric acid was all expelled. Whereas, had there been an excess of lime, it would have retained its equivalent of sulphuric acid in combination as sulphate of lime.

Now if we deduct 4 from the silica, thus leaving the lime in excess, the analysis before calcination would appear as in the following table.

| | | |
|---|---|---|
| Sulphuric Acid | 39.00 | = 83.84 gypsum. |
| Lime | 27.29 | |
| Water | 17.55 | |
| Silica | 11.28 | |
| Alumina | 4.88 | |
| Total | 100.00 | |

After calcination at white heat, the analysis, reduced to hundreds, will appear as shown in column No. 1. of the following table, the succeeding columns showing the kind and amount of silicates and sulphates in the cement.

| No. | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| Sulphuric Acid | 17.10 | | | | 17.10 |
| Lime | 52.07 | — 30.64 = | 21.43 | — 9.48 = | 11.95 |
| Silica | 21.52 | — 16.43 = | 5.09 | — 5.09 = | 0.00 |
| Alumina | 9.31 | — 9.31 = | 0.00 | — 0.00 = | 0.00 |
| Totals | 100.00 | 56.38 | | 14.57 | 29.05 |

| | | |
|---|---|---|
| Silicate of lime and alumina | 56.38 | |
| Silicate of lime | 14.57 | |
| Total silicates | | 70.95 |
| Sulphate of lime | | 29.05 |
| Total | | 100.00 |

Since the days when it became the rule to add an excess of lime for the purposes stated, there have been no artificial cements produced which do not become brittle and glassy with age.

While such a cement is being used, and while under the eye of the engineer, and until the work is finished and has passed inspection, and an occasional examination thereafter, it seems to have acted in a most admirable and satisfactory manner. It has set hard, as was expected, and the matter soon becomes ancient history with the engineer or architect, whose attention is required by things present. And yet this cement is not laid away as though dead. It is not by any means inactive.

Its crystallization is rapid, as evidenced by its prompt induration, and it is this rapid crystallization which inevitably results in rendering the mortar brittle, and thereby liable to subsequent disintegra-

tion, a result which does not follow in the use of well-balanced American rock cements, which, although they do not in the earlier days subsequent to their use exhibit the hardness common with the artificial cements, nevertheless, at a later period, they reach the same degree of solidity, and exhibit a toughness and tenacity of cohesion unknown among the modern artificial cements.

(*To be continued.*)

## CONSUMPTION OF PORTLAND CEMENT IN AMERICA.

IN the April number of THE BRICKBUILDER appears a paper by Wm. G. Hartranft, in which it is argued that the increased use of American Portland cement is not due to the lower price at which it is sold, as intimated in the "Mineral Resources of the United States" for 1894, but rather to the superiority of American Portland cement over that of foreign manufacture.

As the author of the report in the "Mineral Resources" to which objection is made, the writer feels called upon to add a few words in justification of the position at first taken. The only part of the report referring to the relative prices of American and foreign Portland cement is the sentence: "Good American Portland is to be had at 50 cents to $1.00 per barrel less than the best German, and is being extensively adopted for large government and private contracts." This statement refers to retail price of cement delivered on the work, and, as Mr. Hartranft says, applies especially to the trade at interior points. This statement was also made more than a year ago, and since that time the reputation and relative price of American Portland cement have gained to a surprising extent. The prejudice against the American product is rapidly disappearing, and among educated engineers the American and foreign cements compete on fair and equal terms, on the basis of price and quality. The writer has made hundreds of careful tests, during the past few years, of American and foreign cements, and has seen the records of such tests at the offices of city and government engineers at various points. The results show, beyond question, that no cement made in any foreign country shows as high tests, at short or long periods, as that produced at three or four of the leading American factories.

It is also true that American cement has very largely replaced the foreign cements throughout the country. This is especially true of the English and Belgian cements, which are generally considered inferior to the best German. There is no difficulty whatever, at present, in selling a good American Portland in St. Louis or Chicago at a higher price than the well-known brands of English cement. Nevertheless, the fact remains that there is among contractors and sidewalk men a great prejudice in favor of certain brands of German cement, and that the latter still command, in consequence, a higher price than the American. This prejudice is unfounded, and, therefore, certain to disappear in time, but it still exists.

Further, American cements can be profitably made at a price which allows them to be sold cheaper than the best imported German, and where the two come into competition on large contracts, the award is generally made to the American manufacturer on the basis of price. This was clearly shown on the occasion of the letting of a large government contract for cement, at Pittsburgh, last winter.

The offers were as follows: —

| | | |
|---|---|---|
| 1 Belgian cement . . . . . | $2.55 | per bbl. |
| 5 German cements, average price . . . | 2.66 | „ „ |
| 4 American cements, average price . . . | 2.28 | „ „ |

The award was made to one of the companies manufacturing at Coplay, Pennsylvania, to which Mr. Hartranft especially refers as commanding a high figure in Eastern markets, *at the price of $1.99 per barrel.* It does not, therefore, appear that the underselling of the foreign cements is confined to "some of the small Western mills located at interior points," as suggested by Mr. Hartranft.

The fact is that the price of Portland cement is steadily coming down, and the fall is being greatly hastened by the successful competition of American against foreign manufacturers. There can be no doubt that within a very few years practically all the Portland cement consumed in this country will be of domestic manufacture. The prices of cement, however, will hardly be the same then as they are now. When the demand is fully supplied by American factories, we shall have in this country works producing 2,000 barrels or more of cement per day, as in Germany; and the same result will doubtless be reached here as has been reached in Germany, namely, the complete replacement of the common natural-rock cements by artificial Portland.

SPENCER B. NEWBERRY.

## THE HARDENING OF CEMENTS.

SCARCELY any of the raw materials used in building operations is so liable to be deceiving as cement. It was only a short time ago that we called attention to this matter, and urged that some united action should be taken, with a view to obtaining some reliable data from which a standard should be evolved. We seem to be a good deal behind our American and German contemporaries, for their current scientific literature very frequently contains accounts of painstaking experimental work that is being carried out in this direction.

Amongst the latest of these are some experiments by Tommei, who has been endeavoring to investigate the mechanism of hardening, choosing as the substance for experiment, Portland cement. He appears to have subjected samples of set cement of known date to the action of certain chemical solutions, and thus to have estimated their resistance.

He concluded from his experiments that the process of hardening in cements involves the formation of silicates of increasing stability. He believes that the cement has an action upon the sand with which it is mixed — a theory which is in accord with the views of our English experts.

It was not thought sufficient to rely upon the evidence of chemistry alone, and to illustrate the thoroughness with which the investigation was conducted, we may state that microscopic observations were made of thin sections of set cement. These observations showed numerous transparent glassy particles, which were, without action on polarized light, embedded in the mass of cement. Tommei considers these to consist of colloidal silica.

When the age of the cement increases crystals become visible, together with crystalline plates showing double refraction; these are considered to be a consolidated form of the aforementioned colloidal silica.

Other tests were made, including an estimation of the heat evolved by the material during the process of setting. Slow-setting cement gave results which, in heat units, reached 9,331, whilst cement of the same brand, but of a quick-setting nature, gave 7,752. Probably the majority of our readers would have expected the results to have been the other way round.

The general conclusion, then, is that the character and amount of the sand present in a given sample of cement has a very pronounced influence upon its stability when set, and that we should so regulate the composition of the cement as to favor the formation of silicates of increasing stability, if we want to establish a good reputation amongst users; whilst users should only buy such cement as fulfils these conditions. — *British Clayworker.*

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THE ADAMANT CEMENT COMPANY, Allentown, Penn., has been incorporated by William Andrews, Allentown, Penn., Joseph Bird, and John Sheetz, both of Philadelphia. Capital stock of the company is $100,000.

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M. FRANCISCO YRARRAZAVAL, of Santiago, Chili, has been in this country investigating the American methods of manufacturing Portland cement. It is Mr. Yrarrazaval's intention to establish a cement-making plant on his large estate which is at Santiago.

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THE STANDARD CONCRETE MANUFACTURING COMPANY, Camden, N. J., has been incorporated by Messrs. John Donaldson, Cyrus Borgner, and others. Capital stock, $100,000.

# The Masons' Department.

Conducted in the Interests of the Mason and the Contractor for Brickwork.

## THE ARCHITECT AND CONTRACTOR.

BY THOMAS A. FOX. (*Continued.*)

### FORMAL ESTIMATES.

IT is usually provided by law that all public work amounting in value to more than a certain specified sum, usually from one to five thousand dollars, shall be open to free competition, and that the work shall be awarded to the lowest bidder, provided he is a responsible party and files a bond as an assurance of his ability to execute the work in a satisfactory manner. Such provision, while protecting the interest of the contractor in many ways, notably in preventing undue favoritism, and, on the other hand, while it assures unlimited competition and consequently comparative low figures, which tend to give the public the largest return for their money, yet in many instances it works directly against the best interests of both the contractor and the people. In the building business, as in every other, there are different grades and standards of work, and a man who is fully competent to build a warehouse or mercantile structure, and finish it as well as the requirements demand, may be, and usually is, unfitted to do the higher class of work which would be called for, for instance, in a public library or court house. But as the law allows of no discrimination, the low grade man figures high grade work, the public get a corresponding return, and the contractors who figure to do such work as it should be done soon find their time is wasted in such competitions, and refuse to enter them. As a result of this, the field is left open to those who are incapable of doing work which is up to the required standard, for it must be said, notwithstanding all opinions to the contrary, no architect can make a contractor do better work than he is accustomed or paid to do. It seems as if a way might be devised through the associations of builders to overcome this difficulty, and to give the public in important work the services of those who stand highest in the building trades, a result which any one who has had experience in such matters, whether architect or contractor, cannot fail to desire.

A step in this direction has already been taken in Massachusetts, where some of the boards which have in charge the erection of department buildings have the power to select a certain number of contractors to estimate upon the work. In this way the work is figured by a limited number of builders, each of whom is responsible and competent, in which case the lowest bidder can be given the work without hesitation or delay. Although in all public work "the right is reserved to reject any or all bids," as a matter of fact, it is comparatively seldom that the work is given to any but the lowest bidder. If any discrimination is to be made, the way to do it is to limit the number of bidders, and until this can be done few of the abuses which now exist in connection with public work can be corrected.

Of course, in the case of private work, the selection of persons to estimate rests entirely with the owner and architect. And the latter usually makes a selection of some half dozen contractors whom he considers competent to execute the work in a satisfactory manner. As a rule, the owner defers to the judgment of his architect in such matters, but sometimes insists in having the building figured by some one whom the latter considers untrustworthy or incompetent. In such cases it is the duty of the architect to protest as strongly as possible, both on the ground of unfairness to himself as well as to the other contractors who are to compete for the work. Such a matter is of the utmost importance to the architect, for the person in question is usually the one most liable to be the lowest, and the architect is thus often forced to work with some one against whom he is prejudiced from the start, a condition which is practically sure to make friction and produce most unpleasant and unsatisfactory results.

Unless there are good reasons to the contrary, it is only fair to those who are to figure a given piece of work, to let it be known who are to estimate with them, so that if any one of the number feels it is useless to compete, he may withdraw, and not waste his time in estimating when he thinks he has no chance to obtain the contract.

(*To be continued.*)

## LIME MORTAR IN FREEZING WEATHER.

THERE is a popular fallacy to which a great many masons adhere most tenaciously, that the addition of lime to cement mortar is desirable if the work is to be carried out in freezing weather. Upon what reasoning such a solution is based it is impossible to determine, though there seems to be a vague feeling that because the lime in slacking becomes very hot, it therefore must impart a certain portion of its heat to the mortar and so retard any effect of freezing weather. This is not only illogical, but it is not warranted by facts. Lime is slacked in cold water; it is then mixed with cold sand and cold cement, and is on ordinary building operations carried a long distance through the cold atmosphere, so that by the time it is actually laid up with the cold bricks in the cold wall all heat virtue has departed and the lime is absolutely inert in caloric. So much for theory. To determine the practical effect, tests were made last winter during the course of the construction of one of our largest buildings. Upon the coldest day of the winter, when the thermometer registered below zero, two 8 in. square brick piers were constructed under as nearly as possible the exact conditions which would obtain in a wall. The piers were a little over 1 ft. high. One was laid up with mortar composed of 1 part lime, 2 parts cement, and 4 parts sand. The mortar of the other was composed of 2 parts cement and 4 parts sand. The piers were allowed to stand under cover which would protect them from beating storms, but they were exposed to alternate freezing and thawing effects of the temperature during a period of about three months. At the end of that time it was found that the mortar containing lime was considerably disintegrated, so that it could be crumbled easily between the fingers, while the cement mortar, though somewhat injured by frost, was still reasonably firm and hard. The first pier was dropped to the floor through a distance of 4 or 5 ft. and was entirely destroyed, no bricks adhering to each other. Dropping the cement mortar pier through the same distance, it broke in two pieces, and not until it had been violently dashed against the floor six times was it entirely destroyed. Even then some of the bricks broke before the mortar became dislodged.

The reason for this action of the two mortars is very apparent. The addition of lime to cement mortar tends to retard the setting. Consequently there would be a considerable period during which the cold weather could act disastrously upon the mortar. Furthermore, lime mortar sets by absorbing carbonic acid from the air, a process which takes a great deal of time. Cement mortar, on the contrary, sets by crystallization, and a few moments after it is in place in the wall the outer surface has taken a sufficient set to serve as at least a slight protection against the cold, while long before the lime mortar mixture would be hard the cement mortar would be so completely crystallized that the cold would have comparatively little effect upon it. Consequently, the addition of lime to cement mortar is a positive detriment in every sense.

## STANDING ARBITRATION COMMITTEES IN MASTER BUILDERS' EXCHANGES.

EDITOR BRICKBUILDER.

*Dear Sir:* — Nearly all contracts for building work include a proviso that in case of dispute between the contracting parties, the final settlement shall be left to referees under established conditions.

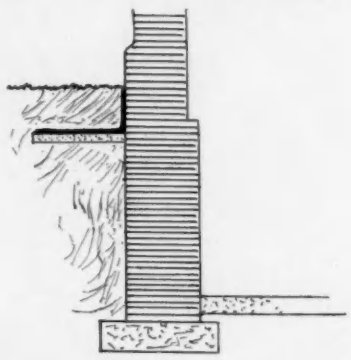
This clause is practically of little value for the reason that the party against whom the referee decides is very apt to appeal to

law. May I be permitted to suggest a way by which, at least, some of the extended litigation might be obviated? The Boston Real Estate Exchange has a standing arbitration committee, and a clause in the by-laws provides that whenever a dispute in which a member of the Exchange is involved is referred to this committee, the member must abide by its decision or forfeit his membership in the Exchange. If the master builders' associations would adopt a similar rule, and would hold their members rigidly thereto, obliging them, under penalty of forfeiture of membership, to abide by the decision of the referees, the moral influence of such action would undoubtedly weigh a great deal in preventing legal appeal on the part of an owner. I believe that most architects and owners who are familiar at all with the workings of master builders' associations would be perfectly willing to leave their cause in the hands of a properly appointed arbitration board and to abide by its decision. Any one who has had any experience knows how unsatisfactory legal combats are, and there ought to be no difficulty in bringing about some such arrangement as suggested. May I intrude sufficiently on your columns to suggest the idea, with the hope that others may take it up, and that the master builders may see fit to provide for some such arrangement?

DU CERCEAU.

## DAMP PROOFING FOR CELLAR WALLS.

THE annexed figure illustrates a detail of construction which is very generally used in New York and in some other parts of the country, though it is seldom met with in the New England States. It is intended to keep the ground water and the washing of rain away from the cellar walls of a building, so as to insure a dry



cellar. About 1 ft. or 16 ins. below the finished grade line a space all around the building is paved with a layer of concrete, which is pitched outwards from the walls. A heavy coat of tar, or better, natural asphalt, is applied to this surface, and carried upon the outside face of the house walls to the grade. The earth is then filled in so as to allow planting up to the walls of the building. Any water which works itself down on the outside walls would be carried away from the building by the underground paving, and there would be little opportunity for the water to work through the walls. Being under ground, the construction would be protected from the action of the elements to a certain extent, and would be likely to endure a much longer time than a paving or stonework laid level with the ground. It is somewhat surprising that this construction is not more generally used, as it would seem to have many very manifest advantages.

## SAFE SCAFFOLDING.

AS the tendency of the law is to make the contractor responsible for accidents to workmen caused by defective or improper scaffolding, it should be one of the chief objects of the foreman to see that every piece of scaffolding is sound, strong, and sufficient. Many a limb has been broken and many a life lost because of the use of rotten or imperfect materials, or because enough nails have not been used in making the scaffold. Every contractor should have in stock a good scaffolding plant, suitable for all work he may be called upon to perform. The English method of using good stout poles instead of sawn scantlings is to be commended, as being safer and stronger, as the fibers of the grain are continuous throughout the whole length of the pole, whereas, in scantling, cross grain and knots render them liable to snap asunder at every sudden shock or strain. In scaffolding, when round poles are used, the putlogs or cross pieces are generally lashed to the poles with ropes, — sometimes with chains, — and this does away with the necessity of using nails to secure the brackets, and leaves the scaffolding undamaged when the work is completed. Taken all in all, this manner of scaffolding, apart from being the safest, is, in the end, much more economical than the old slovenly way of nailing. — *Canadian Architect.*

WHILE it may be rather late in the day to mention the house warming of the Chicago Building Trades Club in their new quarters at 120 Monroe Street, Chicago, it is not too late to congratulate the members on the charming appearance of their club-house on that occasion, or to refer to the character of the club and its membership, which the following extracts from the by-laws will serve to illustrate.

*Object.* — Its object shall be to maintain a club-house furnished with all the requirements for the advancement of social enjoyment and encouragement of friendly intercourse between the members thereof.

*Who Are Eligible.* — The membership of this club shall consist of resident and non-resident members, to which any person of good moral character who is or has been an employer of workmen in a business connected with the building industry is eligible.

To be qualified for non-resident membership, the person must not reside or have a place of business within a radius of thirty miles of the City Hall in the city of Chicago.

The club was incorporated under the laws of Illinois on December 26, 1895, under the following list of officers and board of management: Joseph Downey, president; Robert Vierling, vice-president; E. Earnshaw, second vice-president; Chas. W. Gindele, treasurer; Edward E. Scribner, secretary. Board of Managers: S. S. Kimbell, D. V. Purington, Murdoch Campbell, J. C. McFarland, L. L. Leach, A. Lanquist, M. B. Madden, W. H. Alsip, J. G. McCarthy, Thos. H. Dungan, J. R. Hansell, Wm. Grace, Wm. Mavor, F. S. Wright, and W. D. Gates.

A House Committee and standing committees on Finance and Membership have since been appointed from the members of the Board.

At the banquet on April 23, some very entertaining after-dinner speeches were made on subjects relative to the building trade. Mr. William H. Sayward, secretary of the National Builders' Association of America, made a strong address on "The Building Association and the Result of Its Work."

Mr. D. V. Purington presented the club with a portrait of Mr. Wm. H. Sayward, making some very appropriate remarks upon the well-known labors of Mr. Sayward in his connection with the association, from which the following is quoted: —

"Not alone are those truly great who are skilled in statecraft or in war. In every profession and avocation of life there are men who tower above their fellows. Among philosophers and scientists, among architects, builders, and artists, among lawyers, physicians, and preachers, in each and every department of human energy and intelligence, will always be found some who are preeminently above their coworkers, and who deservedly take rank with the great. No matter how humble the calling, he who stands at the head of that calling is the greatest of his class."

OUR St. Louis correspondent points out very forcibly in this month's letter the evil effect, of building a brick wall with poor mortars and without a proper bond, as witnessed during the recent cyclone, at St. Louis. Nature occasionally makes a test of her own, which, as a rule, is apt to be conclusive, the lessons from which are well worthy of our most serious consideration.

# Recent Brick and Terra-Cotta Work in American Cities.

## A Department Devoted to the Interests of the Manufacturer.

ST. LOUIS. — In a single hour our quiet city was transformed into one of the liveliest, and ruin and devastation was found on every hand. On the morning of May 28, every builder in the city awakened to find himself with plenty of work to do, as the heavy storm which visited us the evening before caused almost incalculable damage to a large portion of the city. In the track of the storm proper there was scarcely a building left unharmed, and probably 20 per cent. of them will have to be rebuilt.

The immediate demand for mechanics exceeded the supply, and in many instances there was a desire to profit by other people's misfortunes. In a few cases exorbitant demands were acceded to, but any attempt to take such an advantage of the situation was discountenanced by labor unions and material-men; consequently there has been scarcely no advance in labor or materials.

The people soon recovered from the shock of the storm, and early the following morning commenced the rebuilding of St. Louis, building stronger and better than before; and already little remains, excepting where buildings were totally wrecked, to tell the tale of one of the severest storms on record.

The hardest part of the storm passed some blocks south of the principal business portion of the city, thereby missing our high buildings; and there has been much speculation as to whether they would have withstood the shock, many having asserted that it is impossible to construct a building to resist such a terrible strain; but this assumption seems to be rather far fetched.

As a rule, the high buildings are designed for an ultimate resistance of 160 lbs. per square foot wind pressure; and although this is a lower figure than should be taken, perhaps, there is no evidence that there was any such pressure as this at any time during the storm in its most destructive center, as it surely does not take anything like this to tear off galvanized cornices, or blow down 9 in. or 13 in. brick walls, which have no bond or anchors, and laid in mortar which does not adhere to the brick, as was found to be the case in every instance where any great amount of damage was done. All buildings which were properly constructed suffered little damage, more than the blowing off of the roof or the chimney, other than that done by the rain. A careful examination of some of the larger buildings, such as factories and warehouses which were damaged, revealed the fact, that they were built without the proper ties and bonds, and often with very poor mortar. The cause of failure in most cases was in the blowing off of the roof first, which was anchored to the walls, and these timbers, in falling, caused the wrecking of other portions of the building.

In the Union Trust and Chemical Building, the two highest in the city, there was no perceptible vibration, although the wind pressure was from 62 to 65 lbs. per square foot.

A large portion of the eastern part of the city which suffered from the storm was in a state of decay, and borders on the wholesale and manufacturing district. There has been much talk of substantial improvements in this section, and doubtless they will now assume more definite shape.

In close proximity to this district are the yards of all the railroads centering in the city, and from these, on Poplar Street, the tracks turn and enter the mouth of the tunnel at 8th and Spruce Streets.

A few years ago the Cupples Real Estate Company established what is known as Cupples Station, by erecting a building covering the entire block between Spruce and Poplar Streets, facing on 7th Street, and extending west, following the curve of the tracks to 9th Street. The building is six stories on Spruce Street, and seven stories on Poplar Street, with basement and sub-basement. Switches from the main line pass through the building, giving excellent shipping facilities to the occupants of the building, it being only necessary to load the goods upon trucks and run them outside of the door, where they are taken in charge by the railroad companies, and may, in fifteen minutes after, be on the way to their destination. It would be hard to conceive of a more admirable arrangement for a building to be used for wholesale and warehouse purposes, and it is hardly necessary to say that no portion of the building ever wants for a tenant.

This venture has proven so popular that during the last two years the same company has erected several other buildings of similar character. Across the tracks, and connected with the first building by iron bridges, they built a five-story and basement building on Spruce Street, extending from 8th to 9th Streets. Directly across the street, on the northeast corner of 9th and Spruce Streets, they erected still another five-story building.

The entire half block between 9th and 10th Streets, facing on Spruce and Poplar Streets, is covered with the immense seven-story and basement, occupied by the wholesale department of the Simmon's Hardware Company, which is connected with the warehouse, which occupies a large portion of the first-named building by an iron bridge, and also by a continuous chain or carrier, by which goods are transferred from one building to another without the use of trucks, and the consequent loss of time and labor. And still further up Spruce Street, on the opposite side of 10th Street, is the six-story building occupied by the Paddock Hawley Iron Company.

The shipping facilities make this the most desirable section for wholesale and warehouses, and the location is appreciated by the property owners, as well as merchants, to such an extent that the future will see the part of the city quickly changed from an almost abandoned to a very busy center.

The buildings referred to above were all built by the same company, designed by Messrs. Eames & Young, and put up by Mr. James L. Bright, and are of the best type of slow combustion. The exterior walls are of brick, dignified and quiet, with terra-cotta or stone used sparingly as an ornament.

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CHICAGO. — The fact was mentioned in this column that the government had awarded the contract for removing the old Post Office Building to a firm who offered $47,000 for the privilege. It turned out, however, that one party was interested in three widely different bids, his scheme being to forfeit the absurdly low pledge of $500 in case there should be no other bids between two of his own, and by having his dummy bidders disappear, he could get the contract at his lower or lowest figure, and by losing the $500 save several thousand. The scheme was detected, and after another delay the contract has been let for $15,000 to the firm who removed the remnants of the World's Fair buildings, and they agree to clear away the massive stone, iron, and concrete ruin in about five months.

Building news continues to be depressing, although there is more or less of important building in progress all the time. The foundations are going in for two more office buildings, and there will soon be others. The building of most interest at present is the Illinois Trust and Savings Bank alluded to last month. The competitive works of sixteen architects hung on the walls of the president's office a week or two, and the prize finally went to D. H. Burnham & Co. The announcement of the award was made June 6. Already the old Grand Pacific Hotel is being torn down, and it will be interesting to note how soon Chicago push will have the new building under way.

The genial treasurer of the American Institute of Architects was a member of the firm of Treat & Foltz until lately, when the veterans who affectionately call each other "Sam" and "Fritz," after pulling together a quarter century, doing a large amount of work and educating scores of young architects at the same time, decided to try it alone and each row his own canoe. One of the former works in which Mr. Foltz takes pride is St. Luke's Hospital.

Among the latest works of the firm are some important manufacturing plants previously mentioned by THE BRICKBUILDER. Their general practise has included many apartment buildings.

People outside of Chicago who have heard so much talk about a Lake Front Park might be surprised to find even now the Illinois Central Railroad Company with a thousand men pushing their part of the work. The depression of the tracks, building of retaining walls, etc., is well along. An interesting part of the improvement is to be a $75,000 suburban underground station. As described, it will be quite elaborate in its appointments. Its beauty will be appreciated chiefly from the interior, since it is to be located under a viaduct and designed to obstruct as little as possible the view of the park and the lake from Michigan Avenue.

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PITTSBURG. — In the competition for the new Carnegie Library at Homestead, the design submitted by Architects Longfellow, Alden & Harlow was awarded first prize; Boyd & Mercur secured second prize, and Bartberger & East third prize.

Architect U. J. L. Peoples is preparing plans for the sixth ward school building, Alleghany, to be three stories, of brick and stone. Cost, $75,000.

Architects Rutan & Russell have prepared plans for a new apartment house and hotel, to cost in the neighborhood of $350,000, to be built at corner of Penn Avenue and 5th Street, and known as "The Lincoln."

The East End Christian congregation are having plans prepared for a church to be erected on Alden Street near South Highland Avenue.

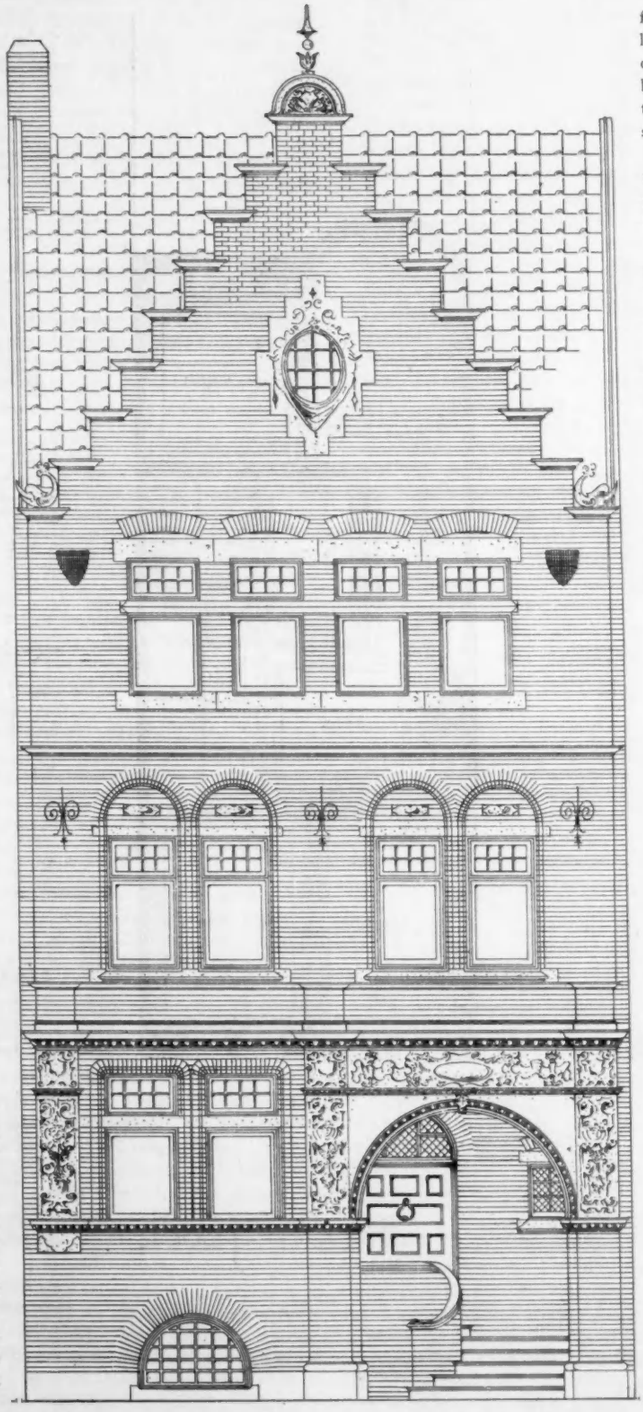
A project is on foot to erect a handsome new theater on Penn Avenue; the estimated cost is $65,000.

Architect J. T. Steen has prepared plans for a brick and stone residence for Capt. John C. Fisher, to be erected on Forbes Street, to cost about $15,000.

A. N. Speer will erect a brick and stone dwelling on Center Avenue, to cost about $19,000.

Architects Topp & Craig have prepared plans for one of the finest hotels in this city; to be erected on the corner of Smithfield Street and Seventh Avenue, fourteen stories high, and to cost about $750,000.

Architect Charles Bickel is preparing plans for a six-story business block on Smithfield Street, to cost about $40,000.



DESIGN FOR A BRICK AND TERRA-COTTA CITY HOUSE, BY LEWIS STEWART.

A row of old buildings fronting on Third Avenue, below Smithfield Street, will be demolished to make way for a handsome business structure to be erected by E. M. Ferguson and the Park estate.

Architect J. Steen has made plans for a six-story business buildng on Smithfield Street.

Senator Quay has recommended to the United States Senate the erection of a public building at McKeesport.

The Columbian Fireproofing Company of this city will remove their offices to New York. Mr. Wright will be in charge.

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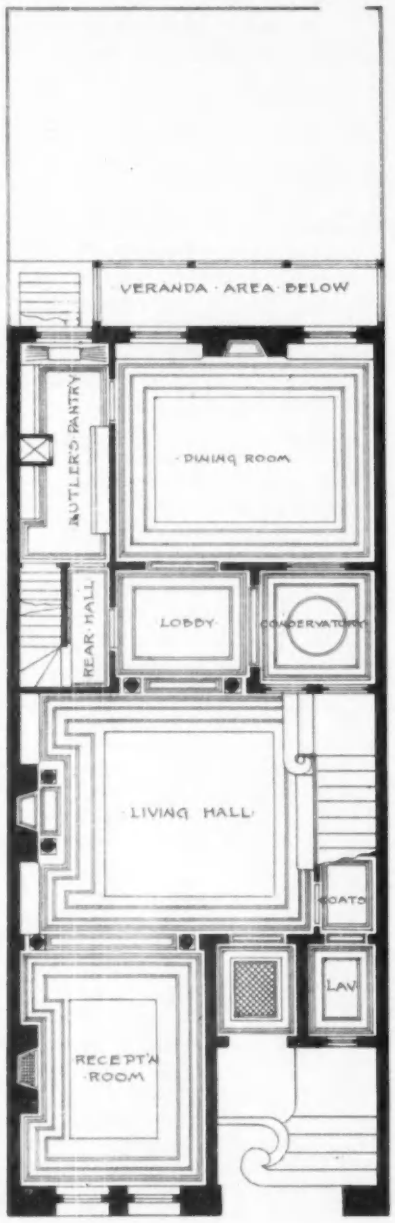
COLUMBUS. — In spite of a very "slow spring," and the indications for a slower summer which confronted us two months ago, the indications now are that the present building season will be one of some activity. All of the architects have work on the boards, and in prospect.

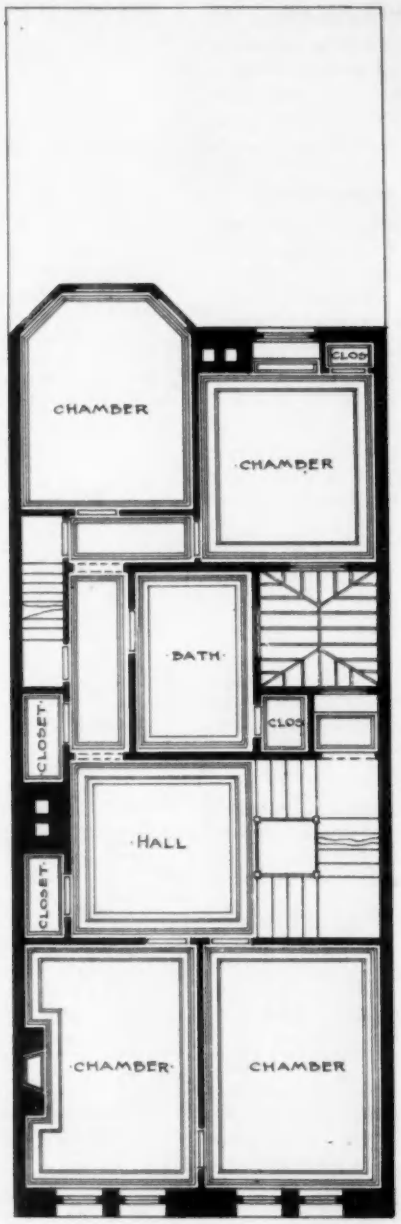
Architects C. A. Stribling & Co. have plans out for a business block for E. T. Mithoff, to be 62½ ft. front by 70 ft. deep, four stories high. The building will be fire-proof, the front being built of mottled Roman brick and terra-cotta.

The same architects report plans completed for a fine brick residence, for Mrs. J. M. Stuart, and a business block for Mr. W. E. Grist, of Circleville, Ohio.

Architect Riebel, who is the School Board Architect, reports a large bottling-house, designed for N. Schlee. It will be of brick, three stories high, 40 by 100 ft. in size. The same architect reports plans completed for a building for Mr. M. Switchell, to be built of brick, except the front, which will be faced with marble. The same architect has plans out for a large school building, to be erected on West Ninth Avenue. It will be built of gray brick.

Architect Linthwaite is




·PLANS·

·FIRST · FLOOR·

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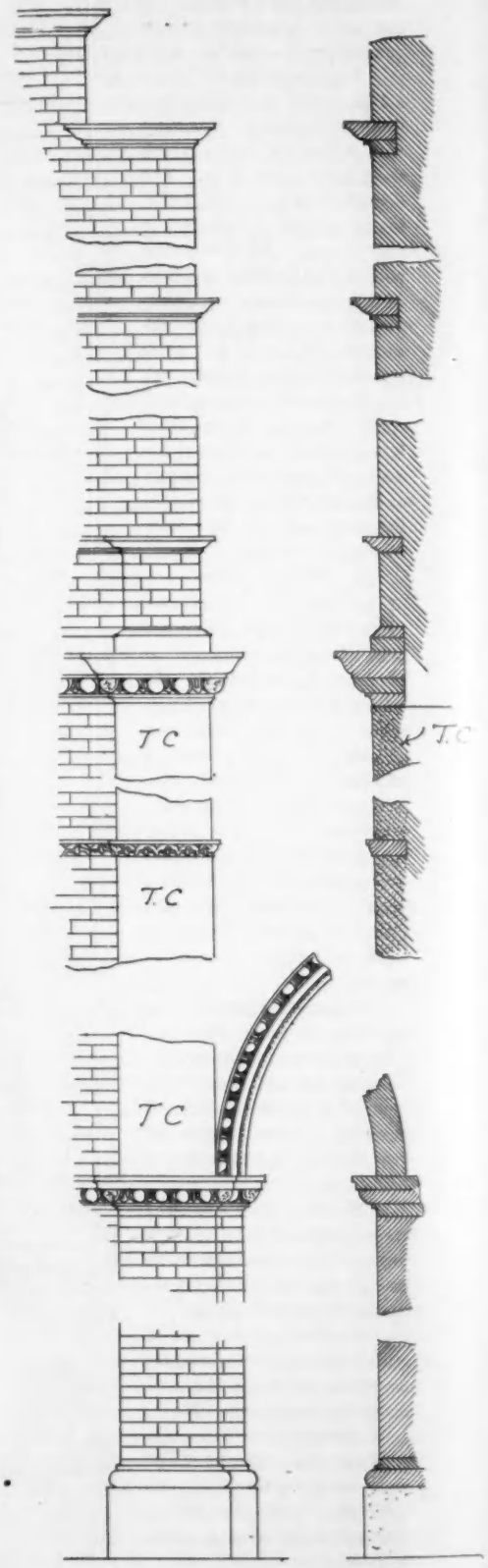


·DETAILS·

DESIGN FOR A BRICK AND TERRA-COTTA CITY HOUSE, BY LEWIS STEWART, TRENTON, N. J.

receiving bids for the construction of a large modern apartment house for Maj. A. D. Rodgers. The building will be three stories high, and contain two flats on each floor, each one of which will consist of eight rooms, private hall, and reception-room. The apartments will be up to the best modern flats of this description, and will be supplied with every convenience.

Architects Yost & Packard have completed plans for a morgue for Franklin County, to be built of brick. The same firm have completed plans for a boiler and power house for the Ohio State University. It will be of brick.

Architect Terrel reports plans completed for a Presbyterian Church, to be built of brick, with trimmings of stone.

Architect Mathews has plans out for an apartment house, or rather a block of seven residences, to be built of brick with stone trimmings.

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DETROIT — The Godfrey & Hyde fourteen-story building, better known as the "Mabley Building," as Mabley & Co. were the prospective tenants for the lower eight stories, has had a rather tough experience. The building should have been completed in April, but early in that month the projectors, being financially embarrassed, chattel mortgaged all their belongings, and being unable to obtain money, the work was suspended, and during the past thirty days liens have been filed daily. On June 10, a joint stock company was formed, to be known as the Majestic Building Company, most of the stockholders being creditors for materials or labor, and arrangements have been completed whereby work has been resumed, with a promise of completion by July 20. The building and site represent an investment of $1,500,000.

The architects very generally report that the month ending the middle of June has been remarkably dull for this time of the year, the fact being due principally to the difficulty of obtaining money on real estate security. Some fine buildings, however, are to be erected at once, among which are the following: —

Messrs. Malcomson & Higginbotham, architects of the City Board of Education, are preparing plans for three twelve-room schoolhouses, two eight-room buildings, and a four-room addition. They will all be constructed of buff pressed brick, with Ohio buff stone trimmings, and will involve an expenditure of $120,000.

Architect Richard E. Raseman has plans for a new plant for the Detroit White Lead Works, whose factory was recently destroyed by fire, including a three-story factory, 47 by 150 ft. in size, two large stockhouses, and an office building. They are to be of fire-proof construction, and will cost $60,000.

Architect William S. Joy has prepared plans for a six-story office building for the Latimer Building Company, limited, to be erected on Lafayette Avenue, near Shelby Street. The exterior will be of pressed brick; the building will contain 140 offices and will cost $55,000.

Architect Thomas A. Hyland has plans for a four-story pressed brick apartment house for Fairbairn Brothers, to be built on Randolph Street, near Miami Avenue, at a cost of $50,000.

A seven-story office building of slow-burning construction is being erected on West Congress Street for George F. Case. The plans were made by John W. Case, of Baltimore. The building will have a pressed brick and iron front, and will cost $60,000.

The plans of architect Edward C. Van Leyen for a police station house for the city were adopted in a recent competition. The building will be 68 by 70 ft. in size, three stories high, constructed of brown pressed brick with brownstone trimmings, with a red tile roof, and will cost $25,000.

Architect Harry C. Stevens has plans for a block of seven two-story residences for S. B. Macklom, to be built of buff pressed brick with Ohio sandstone trimmings, at a cost of $25,000.

Architect Joseph G. Kastler has prepared plans for a temple for the labor unions of Detroit. It is to be three stories high, 90 by 60 ft. in size, with swimming bath, billiard-room, and all modern convenience. It will cost $20,000.

Architects Baxter & Hill have plans for a handsome pressed brick residence for William L. Davies, president of the Acme White Lead and Color Works.

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MINNEAPOLIS. — We seem to be in the midst of a summer dulness, expected in most lines of business, but seldom in the building lines. There is plenty of work being carried out, but very little new work appears. We confidently expect an awakening very soon, and probably a very busy season at the "wind-up."

Among the important projects are the following: —

Architects Long & Kees have planned a large building for the Wyman, Partridge wholesale dry goods company, 132 by 165 ft., seven stories and basement, pressed and ornamental brick, granite, steel construction, fire-proof. Cost, $200,000.

T. B. Walker and others have recently purchased the block of ground used by the Athletic Association, from the McNair estate, and will cover it with large wholesale buildings. This is in the center of the recent extensive improvements around Central Market.

Architect C. S. Sedgwick has planned a store and bank building at Park River, N. D., 50 by 100 ft., two stories, pressed and ornamental brick, for the First National Bank. Cost, $10,000.

Architects Stebbins, of Minneapolis, and McMillen, of Duluth, are at work on plans for a Masonic Temple for Masonic Temple Association of Aberdeen, N. D., to cost $15,000.

The North Star Boot & Shoe Company have let the contract for their new building to P. W. De Lancey, of Minneapolis, at $61,880.

Westminster Church has finally adopted plans, after a competition in which six architects were invited to compete, each being paid a pittance for his work. Architects Sedgwick & Hayes were selected. The probabilities are that the corner of Nicollet Avenue and 11th Street, now owned by Bishop Foss, of the Methodist Episcopal Church, will be the site of the new structure, which will be of brick and cost about $150,000.

Architects Orff & Joralemon, of Minneapolis, have been engaged to prepare plans for a schoolhouse at Stanley, Chippewa County, Wis.

E. P. Overmire is architect for a four-story flat building for W. P. Mealey, on Second Avenue near 16th Street, 48 by 88 ft., ten flats, pressed brick and brownstone trimmings. Cost, $25,000.

The Flour City Realty Company are erecting three double flat buildings at Hennepin Avenue and Kenwood Boulevard, from plans by A. L. Dorr, 60 by 80 ft. each; four stories, red pressed and ornamental brick and brownstone. Cost, $90,000.

Dr. A. H. Lindley will erect a three-story flat building at 16th and Hennepin Streets, to contain eighteen flats. Long & Kees, architects. Cost, $15,000.

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ST. PAUL. — Architects Omeyer & Thori have plans for building at Lakefield, Minn., for Jackson County Bank, 48 by 91 ft., two stories. Cost, $10,000.

Cass Gilbert is architect for an extensive addition to Northern Pacific Company's general office building, to be L-shaped, and extend from Broadway to Pine Street, on 4th Street, and to incorporate the M. & S. L. R. R. depot building.

Milwaukee capitalists have purchased the site of the old Sibley House, and will remove the old building and make substantial improvements.

Bids for insane asylum at New Richmond, Wis., from plans by Buechner & Jacobsen, ran from $39,000 to $55,700. Emil Bruce, of Minneapolis, secured the contract. Same architects have plans for addition to Bethesda Hospital, to cost $15,000.

School board voted to build an eight-room building at Albemarle and Wayzato Streets, to cost $15,000.

J. A. Thornquist, of Minneapolis, is building a three-story flat building on Ashland Avenue, between Kent and Mackubin Streets, to cost $20,000. Herman Kutz & Co., architects.

P. H. Baker will build an apartment building on Ashland

Avenue near Mackubin Street, at estimated cost of $36,000. Kutz & Co., architects.

In the recent competitive examination for superintendent of construction of the new capitol building, there were seventeen applicants. The winner was John Boland, of Minneapolis, who has acted in the same capacity on our new county court-house and city hall building, now nearing completion.

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ROCHESTER seems to be again falling into a state of quietness and depression. All the new work in the architects' offices at present is not more than sufficient to keep one good architect busy.

The chief item of interest has been the competition for a church for St. Paul's Episcopal congregation. The competitors were: — Geo. B. Post and Heins & La Farge, of New York; T. P. Chandler, of Philadelphia; and Cram, Wentworth & Goodhue, of Boston. I understand that Messrs. Heins & La Farge have been selected, their design having been considered to have the best points, one that had no clear-story and no columns in the body of the church, which seems to have been considered a fault in all the other designs submitted. Messrs. Post and Cram, Wentworth & Goodhue had perspectives that were much admired by all the architects and draughtsmen who were permitted to see them. The drawings of Messrs. Cram, Wentworth & Goodhue were unexceptionally well rendered in pen and ink by Mr. B. G. Goodhue.

Architects Chas. S. and Harvey Ellis have let contracts to Stallman Bros. for the erection of a five-story press-brick manfacturing building to be built on Elizabeth Street. Building will be modern in every respect; cost, $92,000. Also for the additions to be made to the Smith Building, to be erected on Exchange Street; cost, $25,000.

Architect J. Foster Warner has let contracts to A. Frederichs & Sons for the "Triangle Building," to be erected on East Main St., Belmont Park, and East Avenue. Building will be five stories in height. New York hydraulic press brick and Perth Amboy terra-cotta, white sandstone first story.

Kelly & Headley have a number of small buildings which are partly or wholly of brick. Stable for T. Ross Levis; three-story hotel, North St. Paul Street; Hotel at Livonia for J. B. Snyder; residence for Mr. John McIntyre, Darmouth Street.

Geo. F. Hutchison is preparing plans for a four-story manufacturing building to be erected on Stone Street. Building will be mill construction. Size, 40 by 60 ft.

J. Mills Platt, formerly head draughtsman for Nolan, Nolan & Stern, has opened an office for the practise of architecture at 918 Chamber of Commerce Building.

Messrs. Kelly & Headley have removed from the Cox Building into the new Cutler Building.

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## GRAY BRICKS.

OF all the tints that are now in vogue, none stands higher in estimation than the divers shades of gray. The reason architects use gray and cream-colored stones is because on weathering they tone down so well. Now, the average brick, as typified by ordinary reds, may tone down as much as it likes, but it never presents that grand appearance characteristic of, say, Portland stone. Gray terra-cotta has made its appearance, and is being highly appreciated. At first it looks rather fresh, and in that respect agrees with the natural product alluded to, but it will soon improve in color and take its rank accordingly. Of course, gray bricks have to be made from suitable earths, and nothing can be expected from the brick earths now ordinarily employed, as gray tints could not result from them unless mixed with chalk or some such substance which would impair their general quality. At the same time, something might be done in that direction, especially with earths not containing an excess of lime, by the addition of certain ingredients depending on the precise character of the earths. — *British Brickbuilder.*

## JUST ABOUT OUR OWN CASE.

WE venture to suggest that the Royal Institute of British Architects, or that younger and more progressive society — the Architectural Association,— should pay a series of visits to yards where various forms of brickmaking are carried on. At the present time the general opinion among younger London architects is that most bricks are made by hand, and there are very few who could detail the essential points of difference between the manufacture of dry and plastic bricks, or have ever seen either of the systems at work. Many architects who have spoken to us upon brickmaking have done so in slightly contemptuous tones, and with a sniff of the nose. These men have never seen anything but small suburban yards, where evil smells abound and confusion apparently reigns supreme. We would like to take some of our friends to the North, or even as far as Peterborough. What an eye-opener it would be to them, and what a far greater interest they would take in bricks after that! — *British Brickbuilder.*

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## AN OLD BOSTON FIRM REMOVES TO NEW QUARTERS.

THE firm of Waldo Brothers, so closely identified throughout New England with the building trade generally as one of the oldest jobbing houses in the line of high grade building materials, announce their removal, July 1, from their present location, 88 Water Street, to 102 Milk Street (three doors below Post Office Square), that they may have better office facilities and a larger display room for the exhibition of the lines of clay products which they handle.

The company was founded in 1869 by J. Adam Waldo, and but two changes since then have been made in the firm. For the last fifteen years, Chas. S. Waldo has been sole partner.

The original office of the company was at the corner of Kilby and Water Streets, within one door of their present location at 88 Water Street. At this last address they have done business for sixteen years. The new store into which they move July 1 is but a block distant, and is centrally located in the business district of Boston.

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## NEW TRADE LITERATURE.

A CATALOGUE of much interest and value is that issued by the Columbus Brick & Terra-Cotta Company, Columbus, Ohio. The entire catalogue is given up to the illustrating of their special make of shaped bricks, and the proper methods for joining different shapes in cornice, angle, and arch work. Size and projection of each brick is given, and almost any question likely to arise regarding the use of shape brick seems to have been answered in this catalogue.

THE PHILADELPHIA & BOSTON FACE BRICK COMPANY will issue this month a very complete catalogue of some forty pages, showing over six hundred patterns of their molded shapes. The bricks are drawn to a scale, and all of the projections are noted on each brick.

It is one of the most complete and best working catalogues of molded brick ever issued. Copies will be sent on application to the company.

THE La Salle Pressed Brick Company, La Salle, Ill., has issued a new catalogue illustrating the shapes and patterns of their brick. All of the illustrations are made at a scale of one quarter to one inch, the projection being indicated on each of the shape bricks. Copies sent on application.

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## FOR SALE AT LOW PRICES.

ONE 75 Horse-Power Engine, Tufts builder, also one 150 Horse-Power Greene Corliss Engine. Both in good order, being removed to install larger plant. Immediate delivery. Address, Goodyear Rubber Company, Middletown, Conn.

## ITEMS WORTH READING AND REMEMBERING.

B. S. TOLAN, Fort Wayne, Ind., has been appointed architect for a new $500,000 court house to be built in Fort Wayne, Ind., for Allen County.

THE UNION AKRON CEMENT COMPANY, of Buffalo, is supplying the cement for the Malone Water Works Company, Malone, N. Y.; also for street paving in Detroit.

THE TIFFANNY PRESSED BRICK COMPANY, Chicago, are furnishing their enameled brick for the Toledo & Ann Arbor Railroad Depot at Toledo, of which W. T. Cooper is the architect.

THE PIONEER FIRE-PROOF CONSTRUCTION COMPANY, of Chicago, have closed the following contracts for fire-proofing: —

Fifth contract on Hennepin County Court House, Minnesota; Wasseca County Court House, Wasseca, Minn.; Fraser & Chalmers's Warehouse, Chicago, besides about a dozen other small contracts.

THE LA SALLE PRESSED BRICK COMPANY, of La Salle, Ill., has opened an office in the Marquette Building, Chicago, where samples of their red, buff, pink, and brown brick may be seen. George B. Engle, Jr., one of the best-known brick men in the country, will have charge.

THE AMERICAN TERRA-COTTA & CERAMIC COMPANY, of Chicago, will furnish the architectural terra-cotta on the following new work: Germania Building, Milwaukee, Wis., Shnetzky & Liebert, architects; House for the Friendless, Chicago, Charles H. Frost, architect; Post-Graduate Medical School, Chicago, Dwight H. Perkins, architect.

THE COMMERCIAL WOOD & CEMENT COMPANY, of Philadelphia, Penn., have opened an office in the Presbyterian Building, No. 156 Fifth Avenue, New York City, to better facilitate the handling of the large trade they are building up in New York and the New England States on their Rosendale and the "Vulcanite," "Commercial," and "Gem" Portland cements.

THE POWHATAN CLAY MANUFACTURING COMPANY, of Richmond, Va., have furnished their light-buff bricks for three store buildings on Main Street, Richmond, and have also closed contracts for five residences on South 5th Street, same city, two of which are faced with red pressed brick, two with iron spotted brick, and one with gray.

THE SAYRE-FISHER COMPANY, whose New York office is at 207 Broadway, will supply their buff brick for the new Astor Hotel, on Fifth Avenue, H. J. Hardenbergh, architect. This firm manufactures their brick after the clay-tempered or mud brick process. By this process the bricks are made very dense and hard, absorbing little or no moisture, and are guaranteed to retain their color.

THE DYCKERHOFF PORTLAND CEMENT, which was used in the Metropolitan Sewerage Construction, Boston, is now being employed in the construction of the Boston Subway. The more interesting features in connection with the construction of this immense Subway will be fully described in later numbers of THE BRICKBUILDER. These will include statistics and data in connection with the use of cements and bricks in this vast undertaking.

THE STANDARD DRY KILN COMPANY, of Indianapolis, have closed a contract with the National Brick & Terra-Cotta Company, of Passaic, N. J., for a ten-track drier, 116 ft. long, for drying soft mud brick, and another with the Ohio Mining & Manufacturing Company, whose office is in New York, 41 Wall Street, for an eight-track drier, 116 ft. long, for drying dry-press brick. This is to be erected at their new plant at Shawnee, Ohio.

THE FAWCETT VENTILATED FIRE-PROOF BUILDING COMPANY, of Philadelphia, has closed the following contracts for their system: new office building, Girard Estate, Chestnut Street, Philadelphia, J. H. Windrim, architect; new office building for Waitman Estate, Chestnut Street, Philadelphia, Willis G. Hale, architect; Physicians' & Dentists' Building, Chestnut Street, Philadelphia, Wilson Bros. & Co., architects; also Catholic Boys' Protectory, Philadelphia, by the same architects.

THE POWHATAN CLAY MANUFACTURING COMPANY, of Richmond, Va., are supplying the red pressed bricks for the addition to the State Lunatic Asylum at Williamsburg, Va., Carl Ruehrmund, architect. Also for the large mercantile building, which is being erected on the site of the old Richmond Theater, Broad Street, Richmond. Their cream-white bricks will be used in the new store building at the corner of Sixth Avenue and 19th Street, New York City, as well as several private residences in same city.

THE CELADON TERRA-COTTA COMPANY, Charles T. Harris, lessee, will supply their roofing tiles on the following contracts: —

Josephine Hospital, St. Louis, Mo., Tulley & Clark, architects; Court House, Knoxville, Iowa, M. E. Bell, Chicago, architect; Electric Light and Power Station, Garfield Park, Chicago, J. L. Sillsbee, architect; Station at Cuba, N. Y., for the Erie Railway Company, G. E. Archer, New York, architect; City Hall, Elmira, N. Y., Pierce & Bickford, architects.

HENRY HUSSEY & COMPANY, 84 Harrison Avenue, Boston, have supplied their Eureka Basin, Bath, and Urinal Traps in a great number of the buildings lately erected in this section, among them being the Grosvenon Building, Providence, Winslow & Wetherell, architects, where some 450 were used; the Litchfield Building, Boston, Cabot, Everett & Mead, architects, where 225 were used; the Castle Square Hotel addition, in which were placed over 400 and the Hotel Savoy, Boston. These traps are constructed on sanitary principles which insure a perfect water seal.

CHAMBERS BROS.' COMPANY, of Philadelphia, who may be depended upon to do business when there is any, have recently taken an order for their brick machinery to be sent to France. This certainly must be taken as an indorsement by the clay-workers of that country, as the company has previously sold their machinery to French manufacturers. In addition to the above, they report that they have just started a complete clay-working plant in Virginia, and are shipping to Tennessee and Georgia machines for making street paving bricks.

G. R. TWITCHELL & CO., of Boston, will furnish bricks on the following work: Methodist Church, Newton, Mass., Cram, Wentworth & Goodhue, architects, 100,000 Ridgway gray brick; apartment house, Shawmut Avenue, Boston, P. A. Tracy, architect, 40,000 Ridgway buff brick; interior work in new station at Providence, R. I., for the New York, New Haven & Hartford Railroad, 100,000 Ridgway buff brick. Messrs. Twitchell & Co. are the New England representatives of the Ridgway Pressed Brick Company, Ridgway, Penn.; also the American Fire Brick & Clay Company, Mineral Point, Ohio.

MEEKER & CARTER, 14 East 23d Street, New York, N. Y., have contracts and are making deliveries on the following buildings: —

Altman Building, 18th Street near Sixth Avenue, Kimball & Thompson, architects, Mark Eidlitz & Son, contractors; white enamel and buff bricks.

Standard Oil Building, Kimball & Thompson, architects, George Vassar & Son, builders; large quantity of buff brick.

Dormitory Building, University of New York, McKim, Mead & White, architects; large quantity of yellow-gray brick.

Besides these they are supplying a number of smaller jobs where quantities of brick used run from 10,000 to 40,000.

THE MOORE & WYMAN MACHINE COMPANY, Boston, Mass., have recently equipped with their elevators, or have now under process of equipment, the following buildings: —

Electric passenger elevators: The Connecticut Mutual Life Insurance Company's Building, Hartford, Conn.; John C. Haynes Building, Congress Street, Boston, Mass.; John C. Haynes Building, Boylston Street, Boston, Mass.; Boston Dry Goods Company's Building, Bedford Street, Boston, Mass.; Watson Estate Building, Franklin Street, New York, N. Y.; A. B. Ogden Building, Madison Avenue and 79th Street, New York, N. Y.

Hydraulic passenger elevators: New apartment house, Annie C. Doyle, owner, 150th Street and St. Nicholas Avenue, New York, N. Y.; Monte Cristo apartments, 123d Street and Seventh Avenue, New York, N. Y.

Freight elevators: Franklin King Building, 74 Purchase Street, Boston, Mass.; Demmon Building, corner East and South Streets, Boston, Mass.; Highland Spring Brewery, Roxbury, Mass.; Dayville Woolen Company, Dayville, Conn.

THE NEW YORK ARCHITECTURAL TERRA-COTTA COMPANY report the following contracts:—

Starting with New York, the chief item in point of size and architectural merit is the Bank of Commerce, Cedar and Nassau Streets, another skyscraper of twenty stories, of which Jas. B. Baker is the architect. An office building on Broadway and White Street, John T. Williams, architect and owner.

In Brooklyn there is a building for the Society for the Prevention of Cruelty to Children, Montrose W. Morris, architect.

The Hartford Fire Insurance Building, Hartford, Cady, Bergh & See, architects, New York.

Baltimore, Md., the Brewer's Exchange, Joseph Evans Sperry, architect.

Philadelphia, the Merion Cricket Club Buildings and the Parish Buildings, Holy Trinity Church, of which Messrs. Furness & Evans are the architects. The contract has also been closed for a very extensive operation on the Girard Estate, from the design of Mr. J. T. Windrim. There is also a large factory building for the S. S. White Dental Manufacturing Company, Boyd, Boyd & Roberts, architects.

In Albany, three residences of a very ornate character, wholly in terra-cotta and brick, the conception of Marcus T. Reynolds, architect, of that city.

IN the last issue of THE BRICKBUILDER, under the title "A Growing Demand for White Brick," the assertion was made that the popularity of the lighter shades was not to be regarded as a passing fad, but rather a permanent adoption of color themes that would continue to increase in favor as time elapsed, by virtue of their lasting attractiveness. This has, in a manner, already demonstrated itself, for the buildings constructed ten or fifteen years ago, in which there was a departure made from the then prevailing dark shades of materials, and light bricks were used, have not only continued in favor, but have added to their popularity by fact of their color having a permanent charm.

A good example of this is the John A. Andrews House (McKim, Mead & White, architects), situated on Commonwealth Avenue, Boston, Mass., which was built some ten years ago of a gray speckled brick of a soft, warm shade. It is well worth notice in this respect, as it has been an object of favorable comment year by year because of this quality of its color.

As a companion to this house in point of similarity in color, is the Webster House, situated on the opposite corner, at 306 Commonwealth Avenue (Dwight & Chandler, architects). At the present writing this last-mentioned house is just nearing completion, a gray speckled brick being used, of 12 by 1½ in. dimensions. The molded work consists of fluted columns and horizontal string-courses of same brick, caps and sills of terra-cotta to match.

In connection with the two houses is an interesting fact which has come to our notice through the courtesy of Messrs. Waldo Brothers, who supplied the brick for both. This is, that the manufacturers, namely, the Perth Amboy Terra-Cotta Company, who made the brick for the Andrews House over ten years ago, have since tried to reproduce the exact shade, but without success until recently, when they succeeded in so doing in the bricks used in the Webster House, which are, barring the necessary toning down of color by exposure, a perfect match.

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